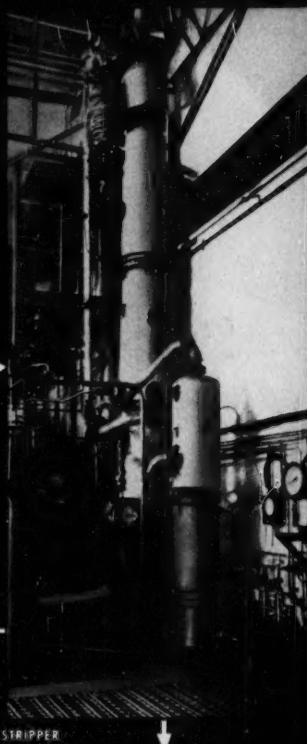
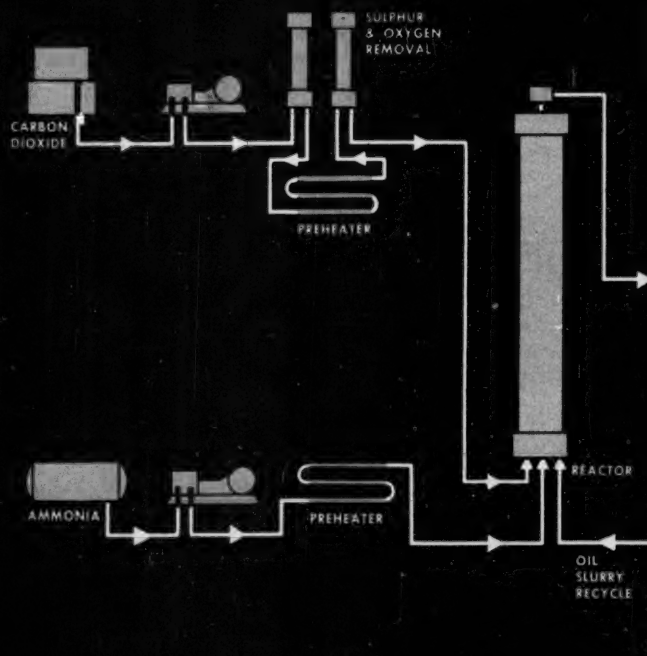


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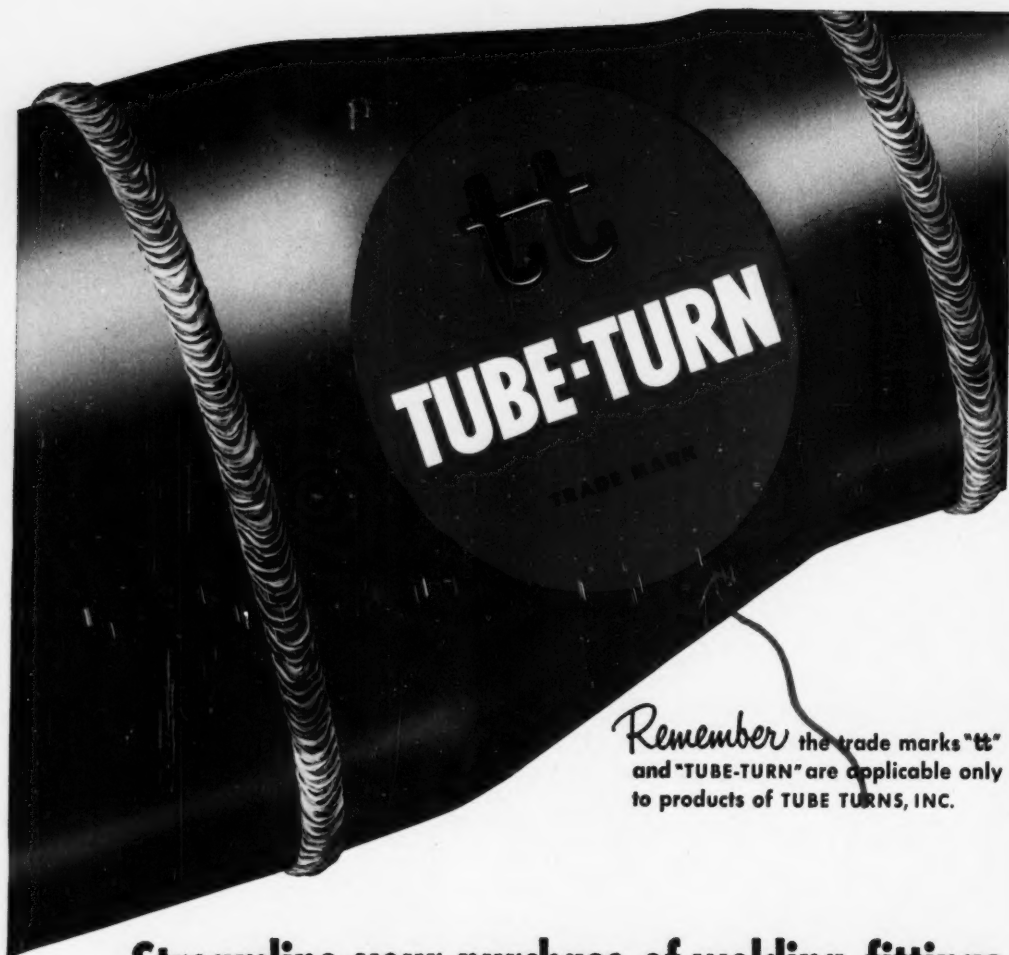
Chemical Engineering



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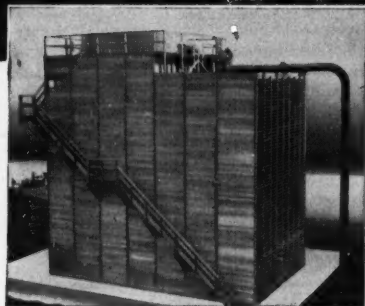
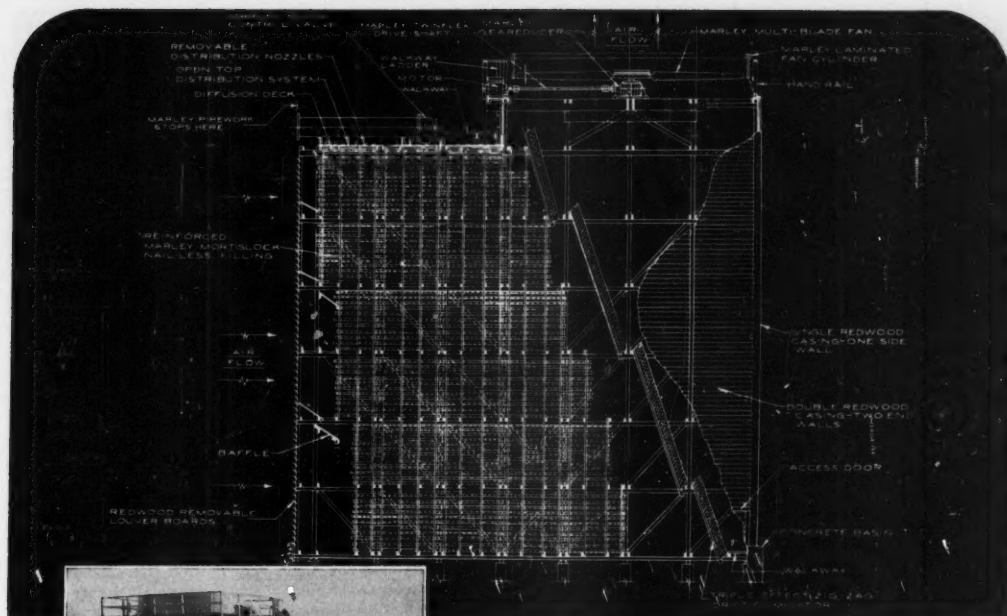


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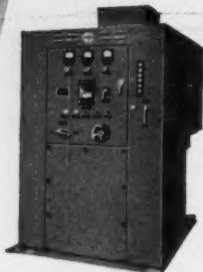
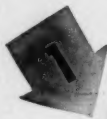
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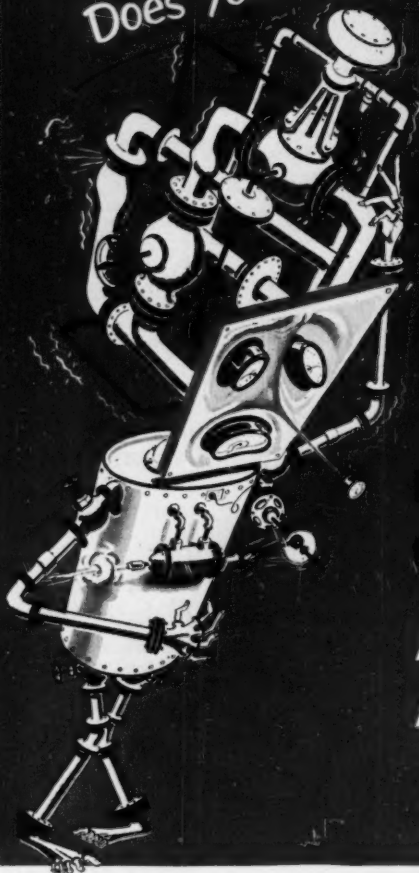
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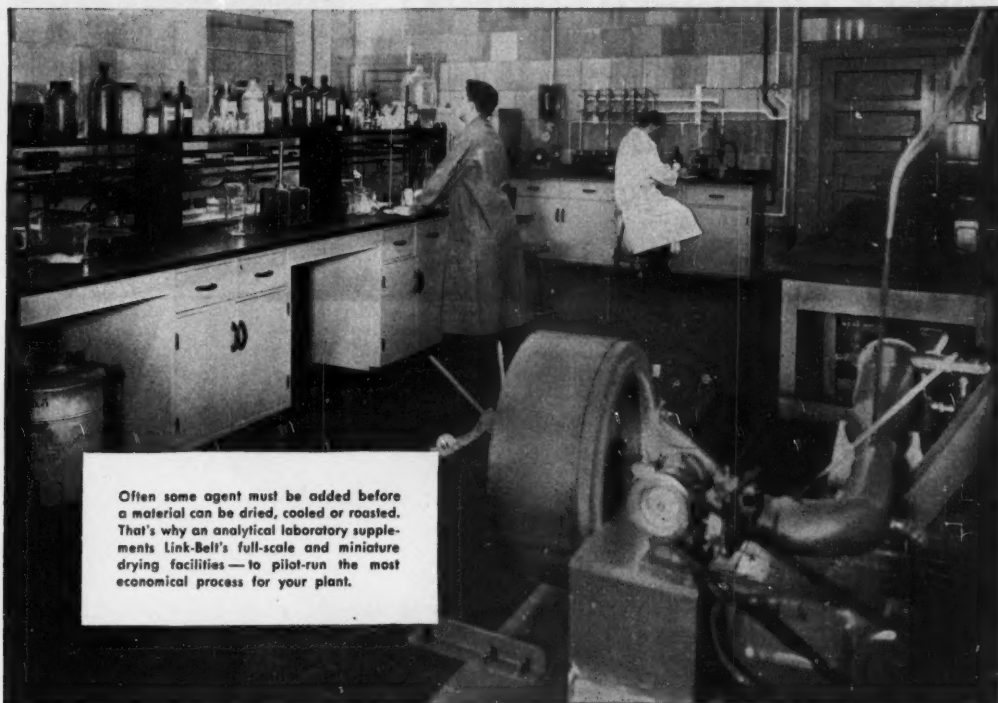


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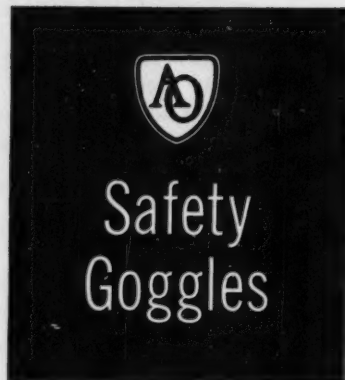
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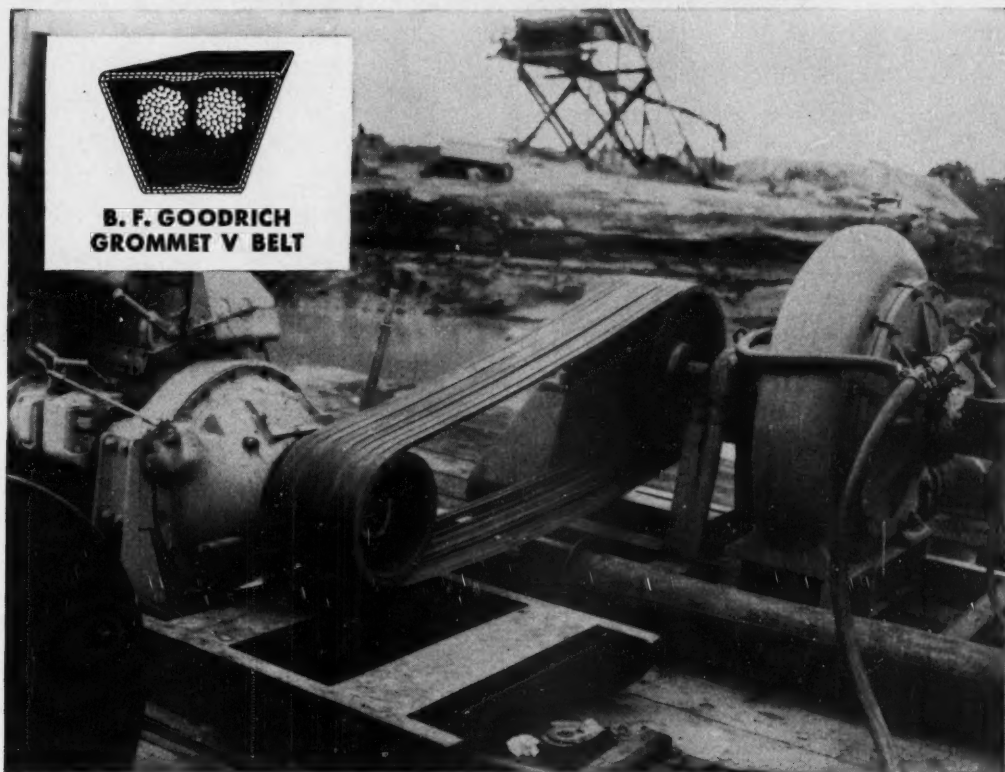
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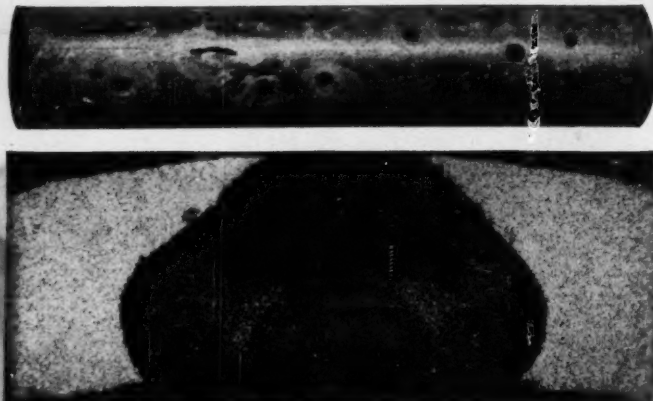
*August, 1951 research study.

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(Top, Fig. 1.) A non-inhibited Admiralty tube which failed from plug-type desincification accelerated by the hot wall effect.

(Bottom, Fig. 2.) Photomicrograph of section of this tube. In the upper half of the corroded area, part of the copper plug has been converted into black copper sulfide, which has dropped out leaving a shallow pit. Unattacked Admiralty is evident on both sides of the corroded area. Mag. 25X.

Improving Efficiency and Extending Tube Life by Good Operating Practices

When a section of a refinery or chemical plant is shut down for major repairs and overhauling, careful examination and diagnosis of tube failures in condenser and heat exchangers are very important as the results may lead to remedying conditions which shortened tube life.

One of the major causes of copper-base alloy tube failures is operating them at temperatures higher than those for which the metal is designed to withstand comfortably. Even intermittent periods of excessive heat may do considerable damage. Consequently, temperature control of various operations is most essential.

A basic cause of overheating may be the clogging or blocking of the tubes which carry the cooling water or liquid. Cleaning and removal of debris at the inlet ends of the tubes should be done as often as necessary. This condition is aggravated during and after stormy periods and floods. The use of screens and strainers to keep foreign matter from entering the equipment can do

much to keep the tubes from overheating. At one plant, shutdowns that occurred every six months have been changed to every 16 months and even longer through careful maintenance and control of operating conditions.

Tube Failure From Hot Wall Effect

Figure 1 illustrates a $\frac{3}{4}$ " O.D., No. 16 BWG non-inhibited Admiralty tube which was removed from a thermal catalytic cracking unit in an overhead condenser. It failed from plug-type desincification after four years service. The tubing had been installed in a horizontal position. Perforation had occurred in the ceiling of the tubing only.

A metallurgical examination of the tube wall showed that plug-type desincification started from the inside (water side). When the plugs of copper extended completely through the tube wall, they were rapidly attacked by the sulfur compounds in the hydrocarbon liquid and vapors surrounding the outside of the tubes. The holes

formed rapidly after the copper plugs had changed to copper sulfide.

The circulating water inside the tubing which was not particularly corrosive, averaged between 110-120°F at the exit end. The product temperature (on the outside of the tubes) was approximately 300°F.

The severe local corrosion which occurred is attributed to the hot wall effect. This occurs where bubbles or debris separate from the circulating water and cling to the metal surface at which points they act as localized heat insulators, the metal approaching the temperature of the hot liquid on the outside. Corrosion at these points proceeds at a higher rate due to the accelerating effect of increased temperature.

Dezincification Can Be Avoided

Dezincification would have been unlikely if arsenical Admiralty (inhibited against dezincification) had been used. This change in alloy should result in increased service life of the tubes.

Suggested measures for increased tube life are:

1. Increase velocity of coolant to dislodge bubbles of gas and debris, but avoid too high water velocities which lead to impingement corrosion.
2. Keep tubes clean. Remove debris, mud, silt or rust promptly.

Changing practice such as increased water velocities may lead to other types of attack such as impingement corrosion. If arsenical Admiralty does not stand up satisfactorily under these conditions, it would be well to consider the use of Arsenical Aluminum Brass which withstands impingement corrosion better than Admiralty and has equal resistance to sulphide corrosion. Where high temperatures are unavoidable and the sulfur content in the hydrocarbons is comparatively low, 70-30 Cupro Nickel should be tried out. This alloy has a higher creep strength at the higher temperatures than the brasses and is also much less affected by ammonia.

The Bridgeport corrosion laboratory will be glad to cooperate with corrosion engineers in refineries and chemical plants on their corrosion problems connected with copper-base alloy tubes.

(8550)

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Here's the

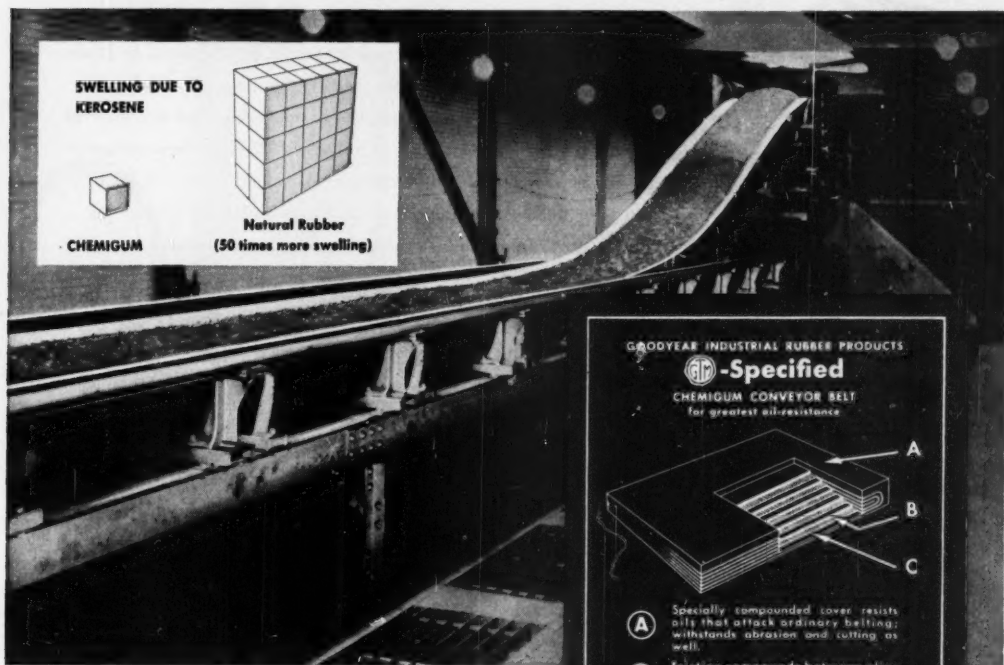
LONGEST-LASTING BELT

for handling Oily Materials

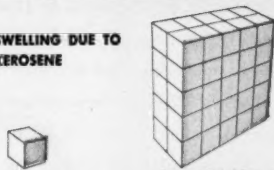
HERE's graphic evidence of the oil resistance built into the covers and carcass of CHEMIGUM conveyor belts—designed by the G.T.M.—Goodyear Technical Man—for use in service where severe oil and grease conditions cause premature failure of conventional belts.

Tests with kerosene show that Goodyear's

oil-resistant CHEMIGUM covers swell only 2% as much as high grade conveyor covers made from natural rubber. (See Chart.) CHEMIGUM will also resist oil far better than many other oil-resisting synthetics used in belts. When destructive effects of such solvents are present, consult the G.T.M. for full details, or write Goodyear, Akron 16, Ohio.



SWELLING DUE TO KEROSENE



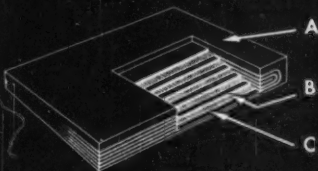
CHEMIGUM

Natural Rubber
(50 times more swelling)

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

GM-Specified

CHEMIGUM CONVEYOR BELT
for greatest oil-resistance



(A) Specially compounded cover resists oils that attack ordinary belting; withstands abrasion and cutting as well.

(B) Friction compounds between plies also resist oil and give belt long flex life.

(C) Plies of duck reinforcement to fit individual job requirements.

LOOK FOR YOUR GOODYEAR INDUSTRIAL RUBBER PRODUCTS DISTRIBUTOR in the yellow pages of your Telephone Directory under "Rubber Products" or "Rubber Goods." He handles Hose, Flat Belts, V-Belts, Molded Goods, Packing, Tank Lining, Rubber-Covered Rolls built to the world's highest standard of quality.

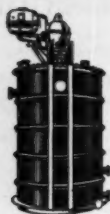
GOOD YEAR

THE GREATEST NAME IN RUBBER

Chemigum—T.M. The Goodyear Tire & Rubber Company, Akron, Ohio

HAYNES Alloy Sheet and Plate

Trade-Mark



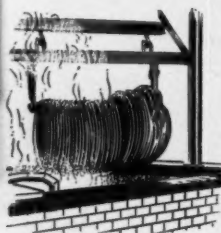
Evaporators



Autoclaves



Agitators



Pickling Equipment

For SEVERE SERVICE conditions

You can obtain sheet and plate of four different HAYNES alloys, all specially designed to combat certain severe service conditions, for the fabrication of processing equipment. The alloys are all strong and highly resistant to heat, oxidation, and chemical corrosion. The chart below will give you an idea of where each is most commonly used.

HAYNES alloy sheet and plate have been used successfully for many different types of fabricated equipment. Typical applications include reaction vessels, condensers, autoclaves, heat exchangers, evaporators, dryers, mixers, agitators, fans, and blowers. The alloys can be fabricated by deep drawing, spinning, pressing, forming, and welding.

All four HAYNES alloys are supplied in hot-rolled sheet and plate in thicknesses of 1 in. down to 24 U. S. Std. (0.025 in.). These materials are furnished annealed and pickled with a commercial No. 1 finish. If you wish further information about HAYNES alloy sheet and plate, contact the nearest Haynes Stellite Company district office.

USE SHEET OR PLATE OF

FOR RESISTANCE TO

HASTELLOY Alloy B
(nickel-molybdenum-iron)

Hydrochloric acid, wet hydrogen chloride gas, sulphuric acid, phosphoric acid, organic acids, high temperatures.

HASTELLOY Alloy C
(nickel-molybdenum-chromium-iron)

Nitric acid, free chlorine, acid salts, hydrochloric acid, sulphuric acid, phosphoric acid, organic acids, sulphurous acid, high temperatures.

MULTIMET Alloy
(cobalt-chromium-nickel-iron)

Oxidation, high temperatures.

HAYNES Alloy No. 25
(cobalt-chromium-tungsten-nickel)

Oxidation, high temperatures, carburization, wet chlorine, nitric acid.

HAYNES

TRADE-MARK

alloys

"Haynes," "Hastelloy," and "Multimet" are trade-marks of Union Carbide and Carbon Corporation.

Haynes Stellite Company

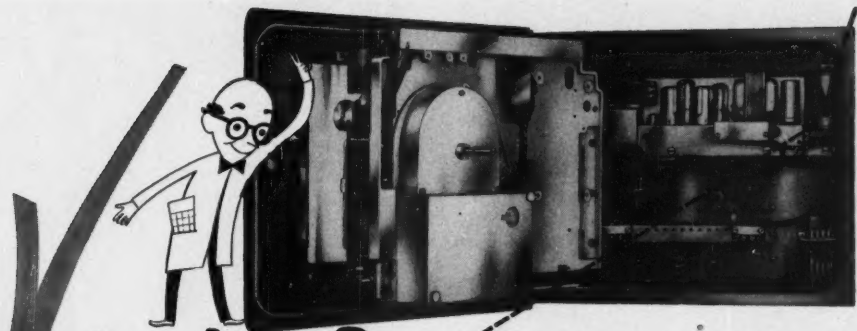
A Division of
Union Carbide and Carbon Corporation

UCC

General Offices and Works, Kokomo, Indiana

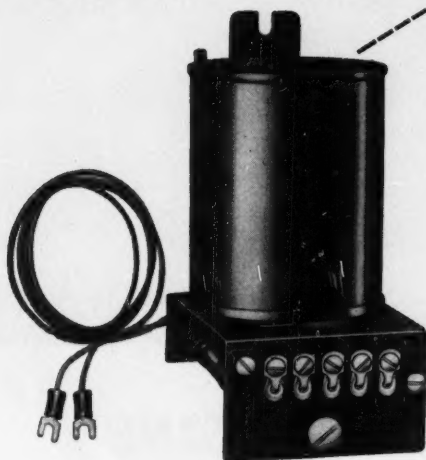
Sales Offices

Chicago — Cleveland — Detroit — Houston
Los Angeles — New York — San Francisco — Tulsa



Check the Components

of the BRISTOL DYNAMASTER Continuous-Balancing Electronic Recorder



The Dynamaster is a superior recording and controlling instrument because every component part is superior.

Take the Syncroverter* Switch; pictured above.

This vibrator-type d-c to a-c converter incorporates so many unique improvements that many scientists, laboratories, and manufacturers are using it in their own devices.

Among its advantages are:

- ✓ Extremely long life
- ✓ Shock-proof and vibration-proof
- ✓ Hermetically sealed against dust and corrosion.
- ✓ 1000-to-1 discrimination against external stray currents
- ✓ Dual reeds automatically cancel out thermal-induced emf
- ✓ Has switching symmetry of better than $\frac{1}{2}$ of 1 percent.

BRISTOL


The Syncroverter Switch is only ONE of the important features of the Dynamaster electronic recorder. For full information, send for Catalog No. P1245.

The dependable Guidepost of Industry

*Reg. U. S. Pat. Off.

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

**BEFORE / BUYING
CHECK BRISTOL!**



BRISTOL	Maker "A"	Maker "B"
HERMETICALLY SEALED ✓	NOT SEALED	NOT SEALED
SHOCK-PROOF ✓	NOT SHOCK-PROOF	NOT SHOCK-PROOF
VIBRATION-PROOF ✓	NOT VIBRATION-PROOF	NOT VIBRATION-PROOF
PRECISION ✓	NOT PRECISE	NOT PRECISE
LONG LIFE ✓	SHORT LIFE	SHORT LIFE
LOW MAINTENANCE ✓	HIGH MAINTENANCE	HIGH MAINTENANCE

THE BRISTOL COMPANY
109 Bristol Road
Waterbury 20, Conn.

Please send catalog giving details of
Dynamaster performance to:

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____





Another Case of "MORE OF THE SAME"

The LaBour Type G pumps in this picture have been in service a little more than three years, handling ammonium sulphate saturated mother liquors. Some time ago we shipped additional pumps of this type to the same user, and as this is written, more of the same are on order.

When a company has had years of experience with a piece of equipment, and continues to buy

more and more equipment from the same maker, there can be only one answer. Most of the business LaBour enjoys today comes from customers who have had previous experience with LaBour pumps, some dating back 25 years and longer.

If you're looking for the kind of dependable pump service that makes you want more of the same, you'll get it from LaBour.

ORIGINAL MANUFACTURERS OF THE SELF-PRIMING CENTRIFUGAL PUMP

LABOUR

THE LABOUR COMPANY, INC. ★ Elkhart, Indiana, U.S.A.





"Putting the Bite"

on a new Plant Site

... is often the first construction move on a turnkey job by Chemical Plants Division. Your project pays off in profits sooner when Chemical Plants Division handles it from plans to production. This start-to-finish supervision includes the services of engineers expert in equipment procurement, construction, and operations. A turnkey contract with Chemical Plants Division assures you over-all coordination and undivided responsibility on your job... both calculated to expedite completion of the project and achieve early payout. Whether your future construction plans involve several thousand or several million dollars, we'd be glad to discuss them with you.

BLAW-KNOX CONSTRUCTION COMPANY

CHEMICAL PLANTS DIVISION

930 DUQUESNE WAY, PITTSBURGH 22, PA.

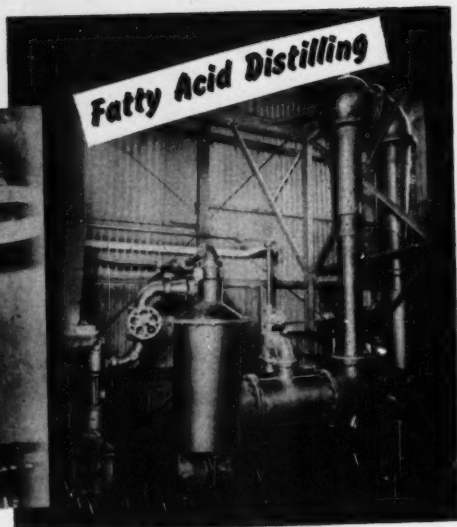
Tulsa 1, New York 17, Philadelphia 3, Chicago 1, Birmingham 3, Washington 5, D. C., San Francisco 5



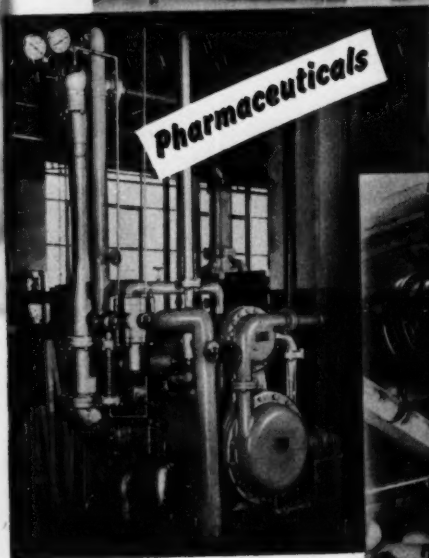
They all pull **VACUUM** with..



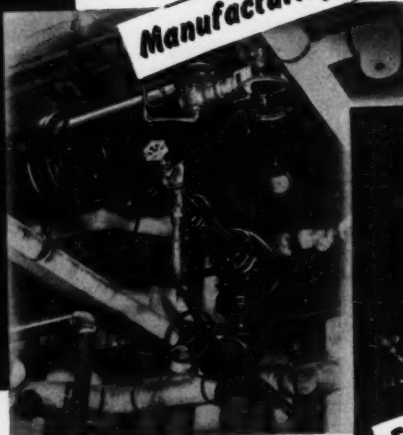
Deodorizing Edible Oils



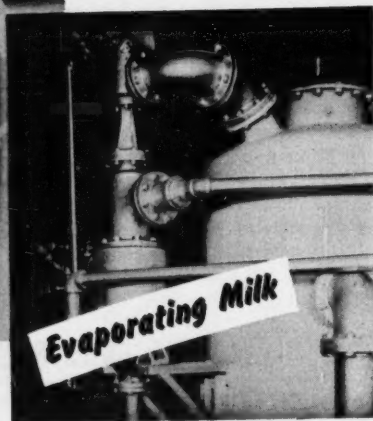
Fatty Acid Distilling



Pharmaceuticals



Manufacturing Resins



Evaporating Milk

.. ELLIOTT

Steam Jet EJECTORS

ADAPTABILITY is the word for it, if a single word can describe the widely divergent applications and operating conditions under which Elliott ejectors are in profitable use. They pull the vacuum needed, anywhere from the small priming ejector you can hold in one hand, to enormous five-stage ejectors for extremely low absolute pressure. One of these big units can almost fill a railroad car.

The recent redesigning of the entire Elliott ejector line has greatly increased the ease with which special conditions and needs can be met. The four major components of ejectors—steam chest, suction chamber, steam nozzle, and diffuser—are shown in the exploded view at the right. By standardizing these elements in various dimensions, an ejector can be assembled which has all the qualities of a specially designed product.

The "know-how" which has backed thousands of successful vacuum installations is yours at command. Consult Elliott engineers on your problem. Contact your local Elliott representative, or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

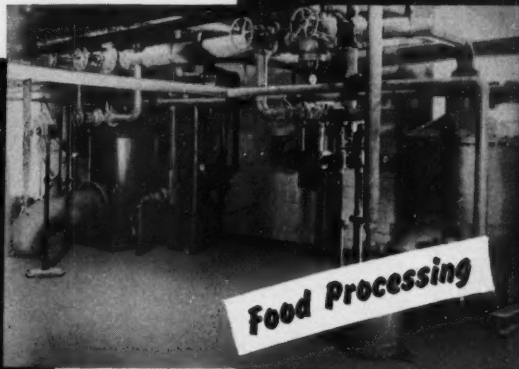


Industrial Process Division

G2-4



Ram Jet Testing



Food Processing



HNO_3

NH_4OH

NaCl

H_2O

H_2SO_4

HCl

HEAVY STEEL PLATE

BONDERIZED SURFACE

FORMALDEHYDE-ALHYD-TYPE ENAMEL

THERMOSET VARNISH

THERMOSET VARNISH

FINAL COAT OF GRAY LACQUER

FIVE PLUS BANDS OF PROTECTION

make this the longest-lived chemical motor

You get more protection against corrosive materials with the Westinghouse Life-Line chemical motor than with any other. Take this example:

An Eastern Fuel and Gas Company has a cyanide pump that pumps thiocyanate. At times the pump leaks, throwing thiocyanate over the motor. Conventional motors rotted out at the feet in about six months. A Life-Line installed on this same pump for over a year brought this statement from the foreman of electrical maintenance:

"This is the first motor we did not have to drill out the bolts and screws to take the motor apart. A closer inspection of the motor showed the end brackets and frame in excellent shape; the fan, windings and rotor looked as good as the day they left the motor plant."

Consider the five plus bands of protection. You'll

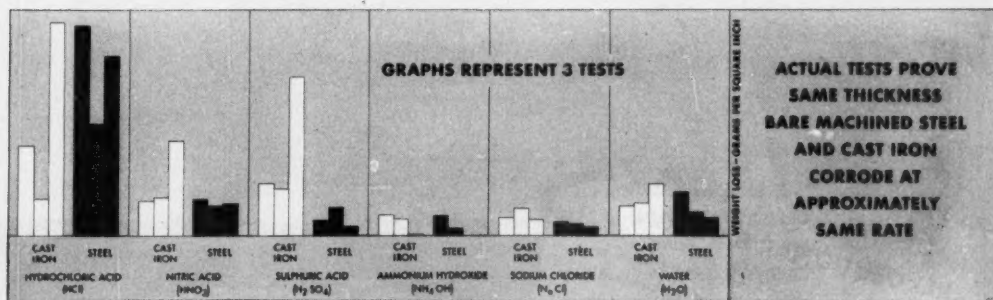
understand this extra life. The frame, feet, and brackets are steel. (Note: Steel and cast iron of same thickness have approximately equal corrosion resistance. See graph below.)

This steel is first Bonderized then a formaldehyde alkyd-type enamel, well known for its superior corrosion resistance, is baked on. Two dips and bakes of tough, flexible Thermoset varnish follow. Finally, the motor is sprayed with a finish coat of gray lacquer. Five bands for longest life!

DO YOU NEED SOMETHING EXTRA IN A MOTOR?

Extra protection against corrosion—or outage from any cause? Check Life-Line—they cost no more. Ask your Westinghouse representative for a copy of Chemical Motor Booklet B-4687, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-21657



YOU CAN BE SURE...IF IT'S
Westinghouse

Life-Line

MOTORS and CONTROLS



The New

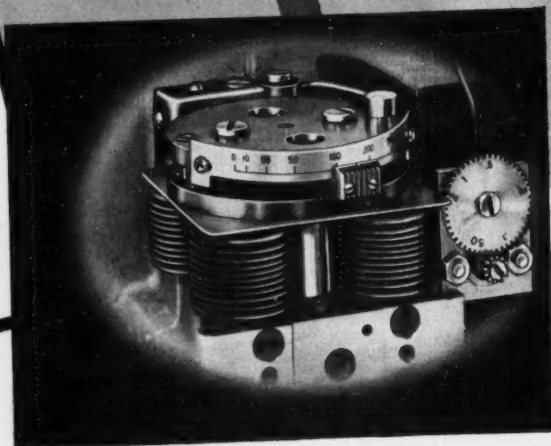
CONSOTROL

*Radically new operating principle . . .
Simplest Installation*



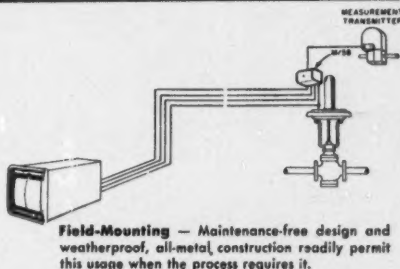
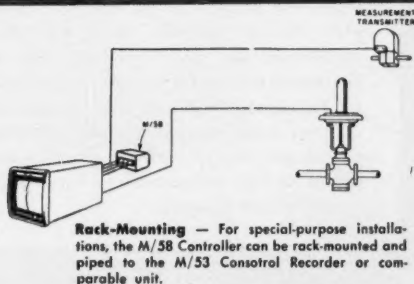
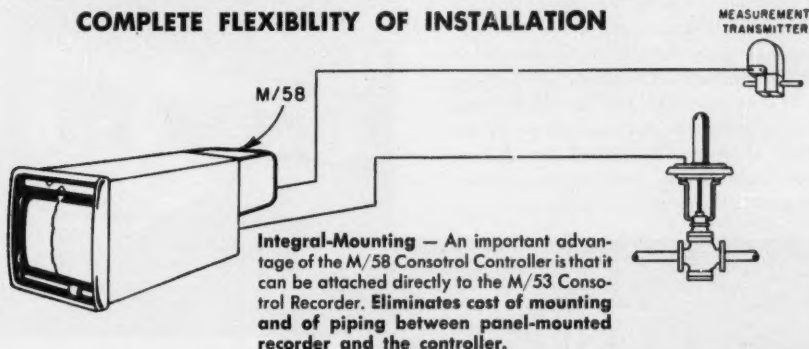
REVOLUTIONARY DESIGN

The unique "floating-disc" balancing system is shown here with dial-type reset adjustment. Derivative unit, when required, is plugged in at left of assembly. Both are readily removed or added in the field — both employ new-design adjustable restrictors providing 1000-to-1 range-ability, perfect reproducibility, and consistent rates on both increasing and decreasing air pressure. Proportional band is a lever setting, fully adjustable from 0 to infinity!



M/58 CONTROLLER

COMPLETE FLEXIBILITY OF INSTALLATION



Over and above its extreme compactness for graphic panel use, the new Foxboro M/58 Consotrol Controller offers unique advantages in its simplicity of design, unmatched performance, and ease of installation.

This Controller employs an exclusive, simplified balancing system in which the measurement, proportional, reset, and derivative bellows act on a single "floating-disc". With no diaphragms, only one nozzle, and only one moving part, it gives control action unrivalled in stability, sensitivity,

and with positive, drift-free control point.

Installation, also, is radically simplified. The M/58 is designed to attach directly to the M/53 Consotrol Recorder (eliminating cost of piping and mounting) or, optionally, to be mounted in remote locations if required.

Write for Bulletin 463 containing full details of the M/58 Controller together with the full line of Consotrol Instruments. The Foxboro Company, 368 Neponset Avenue, Foxboro, Massachusetts, U. S. A. Branches in principal cities.

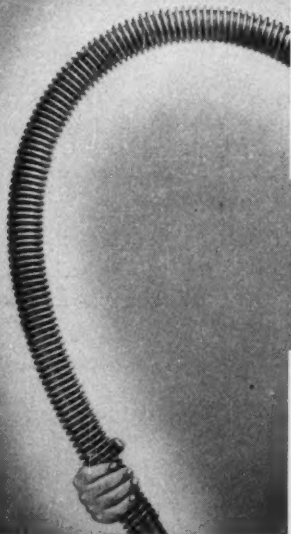
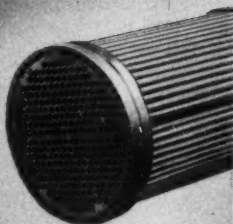
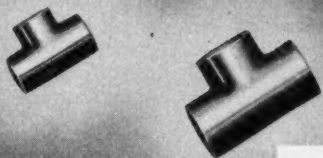
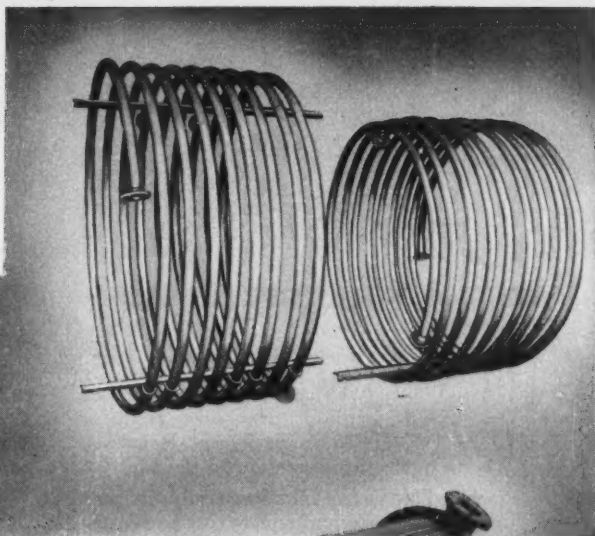
FOXBORO instruments

Reg. U.S. Pat. Off.

INDICATING • RECORDING • CONTROLLING

FACTORIES IN THE UNITED STATES, CANADA AND ENGLAND

*IDEA
for your
FUTURE PLANNING
file*



Useful Information About A Sulphuric Acid-Resisting Stainless Steel



This new 20-page book contains complete information about Carpenter Stainless No. 20 in all forms, sheet, plate, tubing, bar stock, etc. If you now have the typewritten bulletin about No. 20, be sure to replace it with this book containing information never before published. While the use of Stainless No. 20 is limited under present conditions, we want to keep you up-to-date on its performance.

This book contains many field reports describing No. 20's resistance to corrosents such as

Acetic anhydride	Mixed acids
Alkylate	Phosphoric acid
Fluoborate solutions	Sulphuric acid
Maleic acid	Zinc phosphate, etc.

For your copy, just write us a note on your company letterhead.

THE CARPENTER STEEL COMPANY

Alloy Tube Division, Union, N. J.

Export Dept.: The Carpenter Steel Company,
Port Washington, N. Y.—"CARSTEELCO"

Carpenter

STAINLESS NO. 20



Licensed under patents of The Duriron Co., Inc.

Now, from Honeywell... a flow



Wherever supervision of your plant processes requires flow measurement, Honeywell has the right instrumentation for the job.

Included are instruments specifically designed for accurate metering and flow cost-accounting of process fluids, with either linear or square root scales and continuous integration... with a choice of electric or pneumatic transmission from the metering point.

Flow-measuring systems, including proper control, are patterned to your exact requirements

... offer you the advantages of Honeywell's single responsibility from sensing element to control valve. Each part of the system is designed and built with the needs of process designers, production engineers and instrument men foremost in mind.

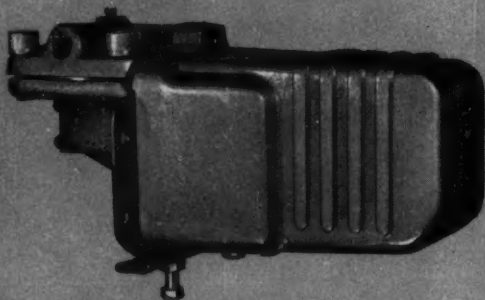
Call in our local engineering representative for a discussion of your application... he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO.,
Industrial Division, 4472 Wayne Ave., Philadelphia 44, Penna.

BROWN DIFFERENTIAL CONVERTER

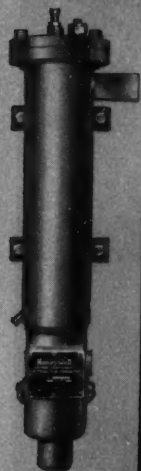
This new flow transmitter, based on the pneumatic balance principle, is setting high standards of precision and simplicity in field operation. Using no mercury, seals or strainers, it converts the pressure differential at the metering orifice into a proportionate air output pressure which is a measure of flow. Response is rapid and accurate. Range is continuously adjustable from 20 to 200 inches of water, and is easily changed in the field without special tools or extra parts. Applicable to either liquids or gases, the Differential Converter is easily installed, cleaned and calibrated in the field.

For graphic panels and other applications requiring compact instrumentation, the Differential Converter is part of a new Honeywell flow control family which includes Tel-O-Set Indicators, Recorders and Controllers. Write for "Centralized Instrumentation—Unlimited," a new brochure describing types of Brown panelboards and instrument components available for industry.

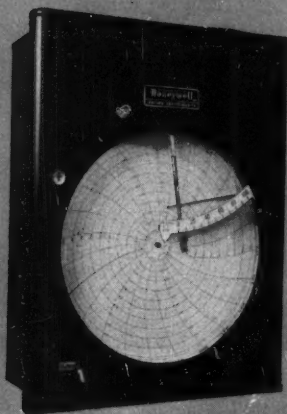


● Important Reference Data... Write for Catalog No. 2281 on the Differential Converter...

meter for every requirement



BROWN EVENLY GRADUATED FLOW METER



Costs for distribution and utilization of fluids can be accurately determined with this meter . . . available as a mechanical meter (with integral meter body) or as an electric meter (with electric transmission from remotely located meter body).

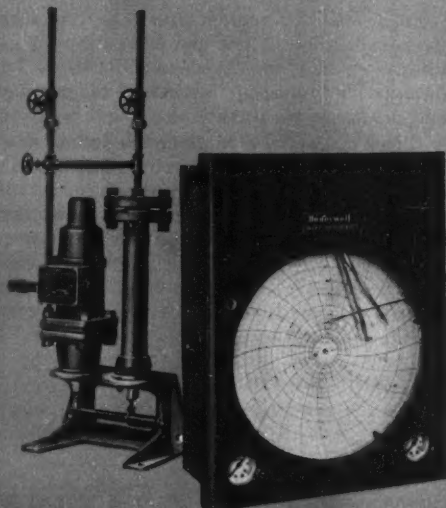
Features linear scale and electronic integration for simplified flow accounting. Electronic integrator is simple, accurate and easily accessible for calibration and inspection. Characterized corrosion-resistant bell automatically provides straight-line flow measurement.

BROWN SQUARE ROOT FLOW METER

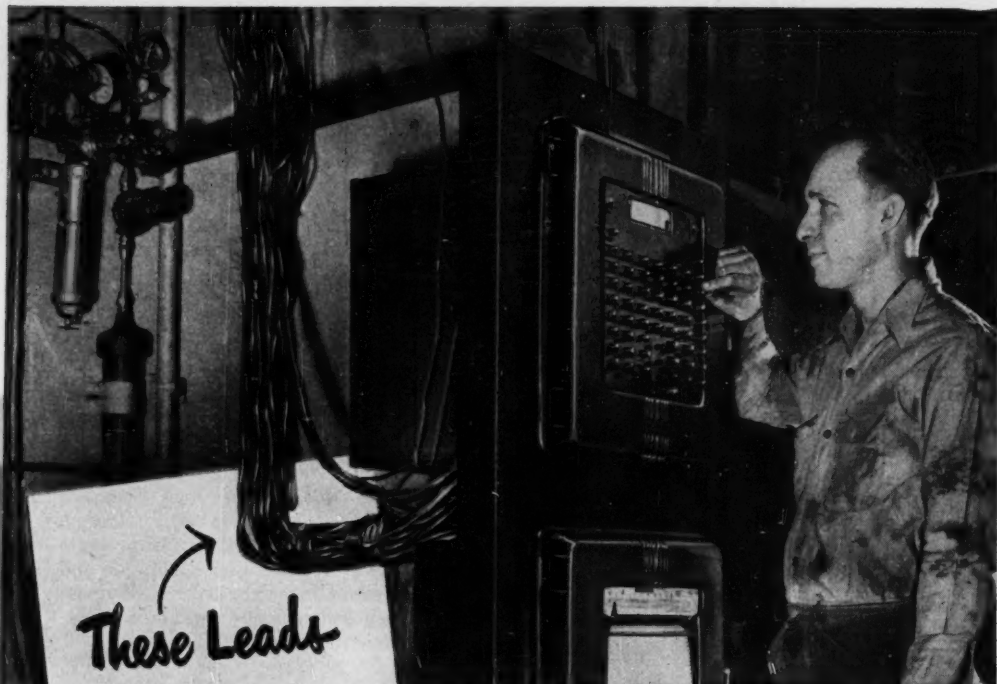
This instrument's expanded, square-root scale affords extra sensitivity for automatic flow control applications. Available with on-off, throttling or Air-O-Line (proportional plus automatic reset) pneumatic control . . . Supplied for use with electric or mechanical meter bodies, in a wide choice of types: low pressure, intermediate pressure and all-purpose—plus sealed armature and area types for special fluids. Interchangeable range tubes afford broad flexibility in the field.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS

First in Controls



Catalog No. 293-1 on the Evenly Graduated Flow Meter . . . Catalog No. 2022 on the Square Root Flow Meter.



These Leads
bring facts
from scores of
sensing elements

Engineers and process operators can save themselves a lot of time and energy in running tests when they use Speedomax Electronic Indicators for "round-up" checks of temperature and other process conditions.

A flick of the finger connects the desired sensing element to the Indicator . . . the instrument's calibrated drum whirls to the reading . . . the drum stops dead still. The entire operation takes only $4\frac{1}{2}$ seconds for consecutive readings at opposite ends of the scale. Minimum time for close-together points is only a fraction of a second. Logging time depends only on the writing speed of the operator.

126 COUPLES ON ONE INDICATOR

As many as 126 thermocouples may be connected to one Indicator without the use of side panels;

with panels the number increases indefinitely. This total of 126 requires toggle-type switches on the Indicator; for rotary and push button switches the totals become 96 and 48. Push buttons are normally supplied with interlocks to assure one-at-a-time operation, but when desired the interlocks can be disconnected so that several switches may be closed simultaneously, causing the instrument to give the average of those points.

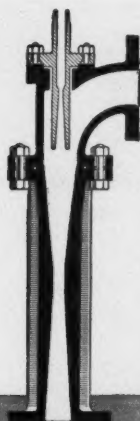
As many as 96 Thermohm electrical resistance thermometers may be connected to the Indicator, using either toggle or rotary switches.

Because the Indicator's scale is not a disc, but the rim or "tread" of a drum-like wheel, the calibration lines are non-radial and hence unusually easy to read. The drum's 25-inch scale has an average of 300 divisions . . . can have 500 if necessary. Enclosed slidewire, and thorough shielding against stray fields, are typical details of high-quality construction.

The equipment is described in our Catalog ND46(1). Whether or not you require this information at present, we will be glad to send a copy for reference. Address our nearest office, or 4916 Stenton Ave., Philadelphia 44, Pa.

LEEDS & NORTHRUP CO.

Instruments • automatic controls • furnaces

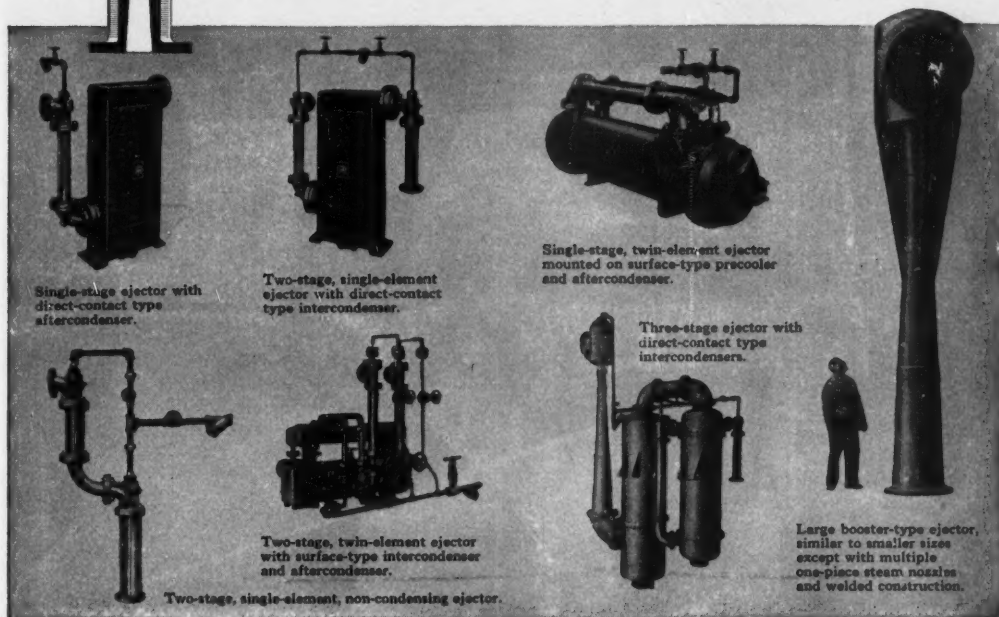


down to .002" (50 microns)

YOU CAN SAVE

operating and upkeep costs

WITH I-R STEAM-JET EJECTORS



Single-stage ejector with direct-contact type aftercondenser.

Two-stage, single-element ejector with direct-contact type intercondenser.

Single-stage, twin-element ejector mounted on surface-type precooler and aftercondenser.

Three-stage ejector with direct-contact type intercondensers.

Two-stage, twin-element ejector with surface-type intercondenser and aftercondenser.

Two-stage, single-element, non-condensing ejector.

Large booster-type ejector, similar to smaller sizes except with multiple one-piece steam nozzles and welded construction.

Whatever the capacity—whatever the gases or vapors to be handled—Ingersoll-Rand steam-jet ejectors can generally do the job far more economically than any other type of equipment. Their utter simplicity of design and operation assures long life and sustained high efficiency, with practically no maintenance at all.

Suction pressure is obtained by a steam-jet discharging into a specially formed suction chamber and venturi-shaped diffuser. That's all there is to it. There are no moving parts to wear out—no excessive noise—no vibration. Ejectors can be installed anywhere, with little or no foundation, and can be operated by inexperienced personnel.

Single-stage, two-stage and multi-stage ejectors can be supplied in any required combination—with pre-coolers, intercondensers and after-condensers to meet the specialized needs of prac-

tically any application for suction pressures down to 50 microns (.002" Hg absolute).

Ingersoll-Rand's unequalled experience in vacuum equipment—both steam-jet ejectors and reciprocating pumps—is your assurance of impartial service in meeting your low-pressure requirements. For further information, contact your nearest I-R representative, or write for a free copy of Bulletin 9013A.



Ingersoll-Rand

11 Broadway, New York 4, N. Y. 442-4

COMPRESSORS • AIR TOOLS • ROCK DRILLS
TURBO-BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS
DIESEL & GAS ENGINES

FOSTER WHEELER

DOWTHERM HEATED PROCESS SYSTEMS

*designed, fabricated and erected
under one responsibility and
with one overall guarantee*

When making an installation of a Dowtherm heated process system in your plant, it is essential that all heating equipment and interconnecting piping, as well as the Dowtherm vaporizer, be properly designed and furnished by a manufacturer with sufficient background in this type of work to know the special problems involved. In 1932 Foster Wheeler Corporation, builders of heat exchangers and direct fired boilers and heaters for the past 50 years, was the first manufacturer to design, engineer, and construct a complete Dowtherm heated process system. Since that time, Foster Wheeler has installed more than 300 vapor generators and—in most cases—has supplied and engineered the entire systems. Some of these installations include Dowtherm vaporizers with capacities up to 35,000,000 btu.

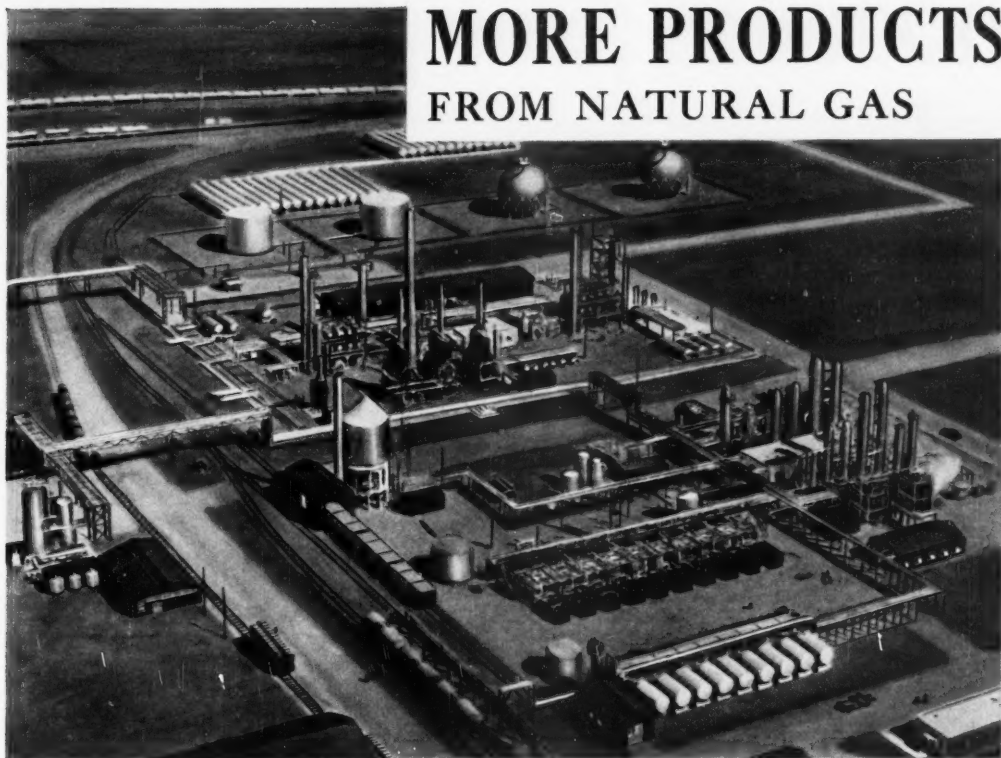
oil deodorization
bodying
fatty acid distillation
resin processing
sterification
anthracene anhydride
ester oil dehydration
phosphoric acid concentration
catalyst heater and
regeneration hypersorption

FOSTER WHEELER CORPORATION

165 Broadway, New York 6, N. Y.

FOSTER WHEELER

MORE PRODUCTS FROM NATURAL GAS

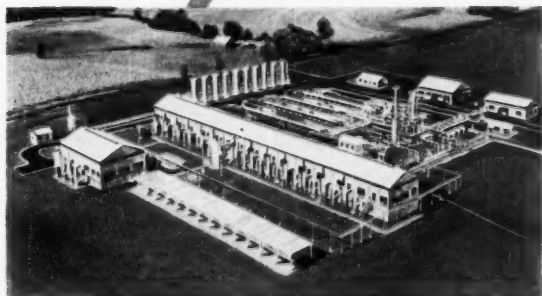


*Mathieson Chemical Corporation Plant
Doe Run, Kentucky*

From Gabe, Kentucky, liquid hydrocarbons extracted from natural gas are piped to Doe Run. Here, at the rate of 450,000 gallons per day, they are converted into domestic bottled gas, natural gasoline, and "permanent" anti-freeze, as well as intermediates for the manufacture of plastics and synthetic fibres.

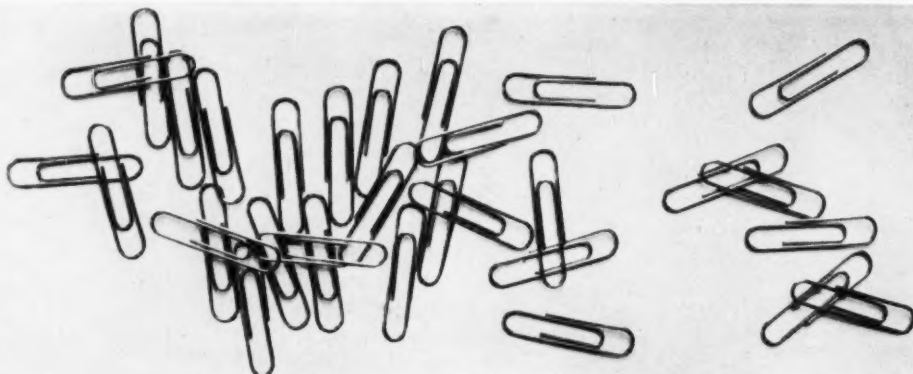
STONE & WEBSTER ENGINEERING CORPORATION BADGER PROCESS DIVISION

AFFILIATED WITH E. B. BADGER & SONS (GREAT BRITAIN) LTD.



*Hydrocarbon Extraction Plant
Tennessee Gas Transmission Company, Gabe, Kentucky*

What do paper clips have in common with **Barrett*** Coal-Tar Chemicals?



Uniformity, of course.

When you buy coal-tar chemicals, you need *uniformity* at a high level of quality.

When you buy from Barrett, you get uniform quality resulting from BARRETT'S BASIC POSITION IN RAW MATERIALS and NEARLY 100 YEARS OF EXPERIENCE IN THE MANUFACTURE OF COAL-TAR PRODUCTS.

Barrett is Basic
... in your business

Barrett Coal-Tar Chemicals

Phenols
Cresols
Cresylic Acids
Xylenols
Pickling Inhibitors
Benzol
Toluol
Xylol
Naphthalene
Hi-Flash Solvent
Phthalic Anhydride
Dibutyl Phthalate
ELASTEX® DCHP Plasticizer
"ELASTEX" 10-P Plasticizer—
(DIOP)
"ELASTEX" 50-B* Plasticizer
"ELASTEX" 28-P Plasticizer—
(DOP)
Phenolic Resins
Niacin (Nicotinic Acid)
Pyridines
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THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
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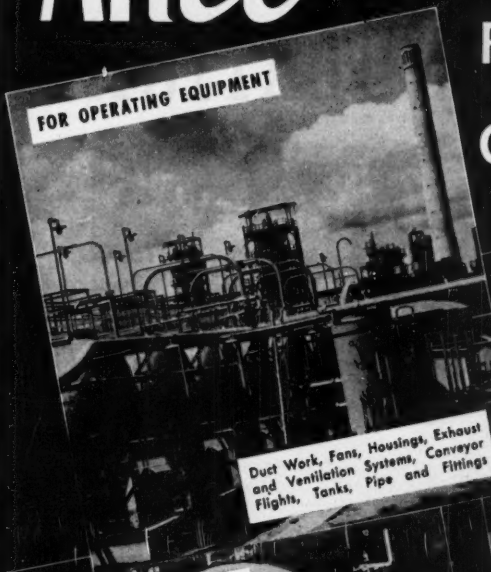
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In Canada: The Barrett Co., Ltd., 5551 St. Hubert St., Montreal, Que.

ARCO *Custom Tailored*

RUBBER PROTECTION FOR THE CHEMICAL INDUSTRY

FOR OPERATING EQUIPMENT



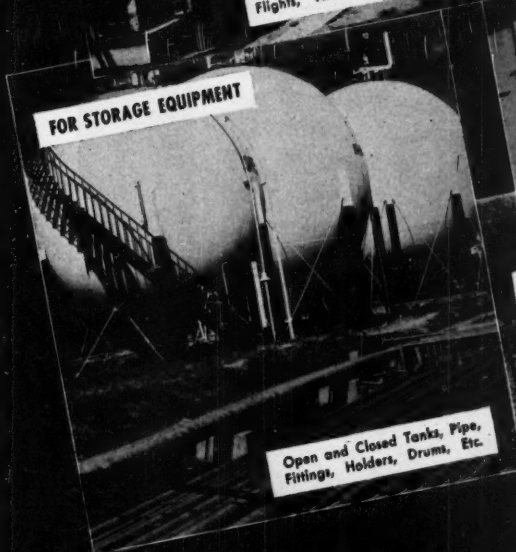
Duct Work, Fans, Housings, Exhaust
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Flights, Tanks, Pipe and Fittings

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Agitators, Filters, Impellers, Pumps, Pressure
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Open and Closed Tanks, Pipe,
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Tank Cars, Tank Trucks and Trailers,
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ARCO engineers are unsurpassed in the custom tailoring of natural and synthetic rubber protective coverings for chemical equipment.

ARCO engineers are available for the designing, fabricating, lining and installing of corrosive-resistant equipment and machinery.

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AUTOMOTIVE RUBBER CO., Inc.

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you save money (*less waste*)
you save time (*almost automatic*)
and you get

UNIFORM GRANULATION

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**AIR SET
ROLLER MILL**

★ You save money when you produce granulated products with *AirSet* Roller Mills because there's less waste. And new automatic design features save operators' time. You have instant and complete control of *AirSet* Roller Mills — one or a battery. Best of all, you get *uniform granulation with minimum fines*. Better feed distribution and uniform pressure at ends of rolls provide ideal grinding for preparation of most chemicals. Push-button control, automatic roll set and roll release and other design improvements give you new grinding efficiency and the closest approach to automatic milling yet devised! They save you money and time. Contact your nearby A-C sales office for complete information or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3613



Motor and Texrope Drive available with *AirSet* Mill as a complete engineered unit.

AirSet and *Texrope* are Allis-Chalmers trademarks.

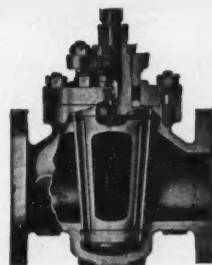
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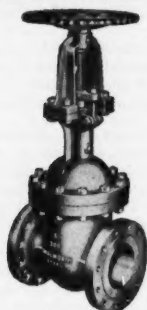
Chemical Milling and Processing Equipment

● VALVES

● PIPE FITTINGS



Walworth
Lubricated Plug Valve



Walworth
Steel Gate Valve



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Iron Body Gate Valve



Walworth
"500 Brinell" Bronze Globe Valve



Walworth
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Walworth
Cast Steel Flanged Fittings

Walworth manufactures a *complete line* of valves and pipe fittings: all made to the highest standards of quality, both as to dimensional accuracy and metallurgical properties. In design, construction, and performance, Walworth products reflect more than a century of experience in the manufacture of quality valves and fittings.

Your Walworth distributor will give you full information on the *complete line* of Walworth steel, iron, and bronze, and special alloy valves and pipe fittings; also Walworth Lubricated Plug Valves, and Walseal* valves, fittings and flanges. Ask for this information today.

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CHEMICAL ENGINEERING—August 1952

MONSANTO

CHEMICALS—PLASTICS

FOR YOUR INFORMATION

Every month Monsanto publishes these pages of pertinent information which may be helpful to you. This issue discusses:

Plasticizers Oil Additives Corrosion Inhibitor
Sodium Phosphates Defoamer AROCLORS
Crop Dusting and Spraying Safety

Additional information on any of these subjects will be provided by any Monsanto Sales Office in response to your request by coupon or letter.

New Monsanto Plant Expands Plasticizer Production and Service to Industry

Construction of Monsanto's new DOP plant at Everett, Massachusetts, expands both the production of Monsanto Plasticizers and service to the Plastics Industry. The new plant is in operation now.



Diethyl phthalate (DOP) and di-isooctyl phthalate are being produced at the plant. Shipment of other plasticizers also can be made from Everett. The plasticizers are available in tank cars, compartment tank trucks or drums. This permits you to order Monsanto Plasticizers in the quantities you need and at economical prices.

Monsanto is a basic manufacturer of DOP. Monsanto's family of plasticizers is the most versatile in the world. This permits you to make selections of the right plasticizer, or combination of plasticizers, needed to give your product the special qualities you want. It enables you to plan your formulations for: either price or qual-

ity competition and get the plasticizers you need from a single source.

Monsanto Plasticizers are readily available, with prompt shipment being made from Everett; Akron, Ohio; New York, N. Y.; or St. Louis, Mo.

In addition to prompt delivery, Monsanto offers you technical service in the selection of plasticizers to do the job your production requires. This technical service is yours for the asking.

For information on Monsanto Plasticizers and for details on the technical service, contact the nearest Monsanto Sales Office or mail the coupon.

Send for new bulletin on formulating adhesives

The formulation of heat-sealing and heat-sensitive adhesives is a feature of a new technical bulletin just issued by Monsanto. Mail the coupon for your copy of Monsanto Technical Bulletin No. O-81, featuring Santicizer*3.

The bulletin includes typical formulations of nitro cellulose heat-sealing coatings and paper coating lacquers, polyvinyl acetate adhesives, zein metallic decorative paper coatings, back-coatings for pressure-sensitive tapes and hot melts for paper adhesives. Santicizer 3, in addition to its use in adhesives, has a number of other applications.

Your copy of Bulletin No. O-81 will be sent to you promptly upon receipt of the coupon at the bottom of the next page.

"Safety for Pilots on the Crop Air Drop"

Recognizing the importance and growing use of light airplanes in spraying and dusting insecticides and herbicides, Monsanto has published a pocket-size booklet, "Safety for Pilots on the Crop Air Drop." Monsanto is a leading producer of insecticidal and herbicidal chemicals. The booklet gives details on the properties and need for safety in handling various chemicals for controlling weeds and insects. Your copy will be sent, free, if you will mail the coupon.

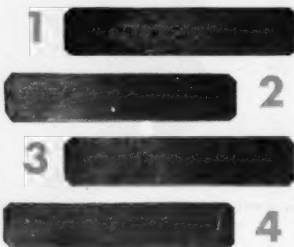
If corrosion is your problem, take a look at Monsanto Santolene C

Monsanto Santolene* C offers you an effective and economical solution to the problem of corrosion in the storage and transportation of light petroleum products.

The illustration below shows how Santolene C stops corrosion. In addition to convincing proof in extensive tests, Santolene C has demonstrated its effectiveness in service. It has been used by major oil companies for more than two years.

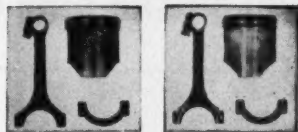
Santolene C is product-soluble. It burns completely with fuel, leaving no residue. Tests in both gasoline and diesel engines show that the additive does not reduce engine cleanliness, causes no injector fouling, and has no adverse effect on engine performance. Mail the coupon for a copy of Monsanto Technical Bulletin No. O-62, which contains information that may be worth money to you.

Test shows how Santolene C stops corrosion



SANTOLENE C PROVED its effectiveness in this test. Metal strips illustrated were immersed in gasoline containing various amounts of Santolene C. 1. Control, containing no Santolene C. 2. Strip from sample containing Santolene C at the rate of 3 pounds per 1,000 barrels. 3. Strip from sample containing Santolene C at the rate of 5 pounds per 1,000 barrels. 4. Strip from sample containing Santolene C at the rate of 7 1/2 pounds per 1,000 barrels. If you want to make a similar test with your own products, we will be glad to supply a sample of Santolene C.

Santolube solves "Stop-Go" problem



Parts from engine of "stop-and-go" driver using a good premium lubricant.

Parts from "stop-and-go" driver's engine lubricated with oil improved by Santolube.*

Of every 100 miles traveled by the average passenger car, 70 to 85 miles are "stop-and-go" driving. Such operation forms organic acids that cause high engine wear . . . partially oxidized fuel and other contaminants that built up engine deposits and cause excessive wear and oil consumption. This problem of the "stop-and-go" driver can be solved by improving lubricants with Monsanto Santolube with these special properties. Mail the coupon for details.

EFFECTIVE DEFOAMER

If you have a problem of holding down foam, why not try Monsanto Sterox* 110? Sterox 110 is a high-molecular-weight alcohol ester with excellent defoaming action. Mail the coupon for a copy of Monsanto Technical Bulletin No. P-140.



**Sodium
phosphates**
efficient helpers
in many industries

Many an American industry has found its processes easier and more efficient because of Monsanto Sodium Tripolyphosphate or Monsanto Tetrasodium Pyrophosphate.

These two important members of the polyphosphate family are used as detergent

aids for synthetic detergents, in dishwashing compounds, in bottle washing, in dairy cleaning, in metal cleaning, in paper deinking and as a soap builder.



Sodium tripolyphosphate (STP) is one of the newest sodium phosphates. It has excellent calcium sequestering power, outstanding detergency, high solubility in water and superb physical and chemical stability.

The sequestering action and water softening power of STP are important in the control of hard water. When soap is used in cleaning operations, STP prevents the formation of insoluble scum and curds. Such insoluble curds impair quality in numerous industries, particularly in the manufacture of textiles.

High detergency is a valuable quality of STP. When combined with other alkalies, synthetic detergents or soap, STP adds substantially to the compound's cleaning power.



Tetrasodium pyrophosphate (TSPP) combines properties as a water softener, emulsifier, dispersing agent and deflocculating agent. It is a builder for soaps and synthetic detergents. TSPP is characterized by unexcelled purity and chemical and physical stability. The synergistic action of TSPP makes it one of the most valuable of Monsanto Polyphosphates.

For information on Monsanto Sodium Phosphates, contact the nearest Monsanto Sales Office or mail the coupon.

AROCLORS improve maintenance paints ... other applications

Monsanto AROCLORS (chlorinated biphenyl and chlorinated polyphenyls) improve maintenance paints, serve as plasticizer and resin extenders, perform effi-

ciently as a heat transfer medium. Economical AROCLORS are in plentiful supply.

Some of the principal uses of AROCLORS are:

In Plisite S-5 and Marbon 9200—Contribute fast-drying properties, provide excellent protection against acids and alkali, moisture and other common corrosive influences.

In Maintenance Paints—Metal-surface paints made with an AROCLOR* gain resistance to water, acids, alkali and other corrosive influences. The AROCLORS contribute to nonflammability, adhesion, gloss. The AROCLORS have good electrical properties. They also are used in modified and synthetic rubber coatings, lacquers, hot metal strip coatings, vinyl protective coatings, wood-sealer formulations and marine paints. Mail the coupon for literature.

How to cut plasticizer costs

Many users of plasticizers are cutting costs without reducing quality through the use of Monsanto HB-40. HB-40 (partially hydrogenated terphenyl) is a low-cost extender-type plasticizer for such products as vinyl extrusions, vinyl pastes, vinyl slush moldings, vinyl calendaring . . . and as a primary plasticizer in polystyrene casting resins, polystyrene adhesives, molding polyvinyl carbazole, strip coatings for metals, floor tile compositions and asphalt base paints. Mail the coupon for complete details.

MONSANTO CHEMICAL COMPANY, 1700 South Second Street, St. Louis 4, Missouri. District Sales Offices: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle, Twin Cities. In Canada, Monsanto Canada Limited, Montreal.

*Reg. U. S. Pat. Off.



SERVING INDUSTRY...WHICH SERVES MANKIND

SEND INFORMATION: ☐ Plasticizers. ☐ Technical Service on Plasticizers. ☐ Santolubes. ☐ Sodium Phosphates. ☐ HB-40.

SEND LITERATURE: ☐ AROCLORS for use in

☐ Booklet (Safety for Pilots). ☐ Bulletin No. P-140 (Stereox 110). ☐ Bulletin No. O-81 (Santolube 3). ☐ Bulletin No. O-62 (Santolene C).

SEND SAMPLE: ☐ Santolene C;

MONSANTO CHEMICAL COMPANY
1700 South Second Street, St. Louis 4, Missouri

Please send, without cost or obligation, information, sample or literature as indicated at left.

Name.....Title.....

Company.....

Street.....

City.....Zone.....State.....

Savings up to 42% on fuel oil and lube oil

*Fairbanks-Morse does it
with dual-fuel engines*

...all Ross Exchanger equipped!

"Put your power costs in order with Fairbanks-Morse dual-fuel engines." That F-M statement is based on facts like these:

In Minnesota, fuel costs cut 42 per cent. In a Kansas power plant, savings of \$19,000 a year in fuel and lube oil. In Arkansas, overall savings of \$33,000 annually!

To achieve such economies, many of the engines are in 'round-the-clock operation. Naturally, that means all components must give the same unflinching performance. Take the Ross Exchangers for example. They are and *can be* depended on to keep lube oil and jacket water at proper temperature levels. Downtime or lowered performance through overheating can't be risked.

That's why, on Fairbanks-Morse installations, such as the ones shown, you so frequently find Ross Exchangers among the principal equipment. Fairbanks-Morse must safeguard its own in-built quality with components of equally known dependability.

For Diesel, gas or dual-fuel engines of any rating, pre-engineered Ross Exchangers have unequalled advantages: standardization that simplifies engineering, diversification of standard sizes to cover most requirements, and choice of materials for specific conditions.

Details of construction, engineering data and collaboration on your specific needs gladly furnished. Bulletin 2.1K1 mailed on request.

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DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

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In Canada, Horton Steel Works, Limited, Fort Erie, Ont.

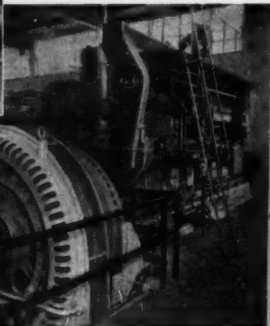
ROSS

EXCHANGERS

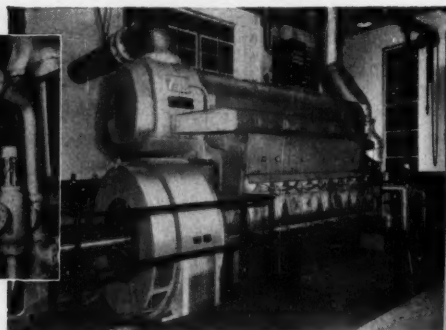


Serving home and industry

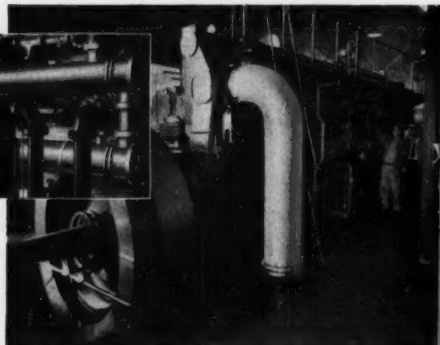
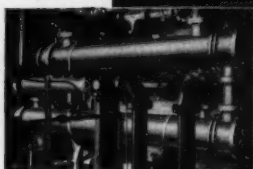
AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANE-BOILERS • ROSS HEATER • TONAWANDA IRON



Fairbanks-Morse 1400-hp dual-fuel engine equipped with Ross Exchanger for lube oil cooling.

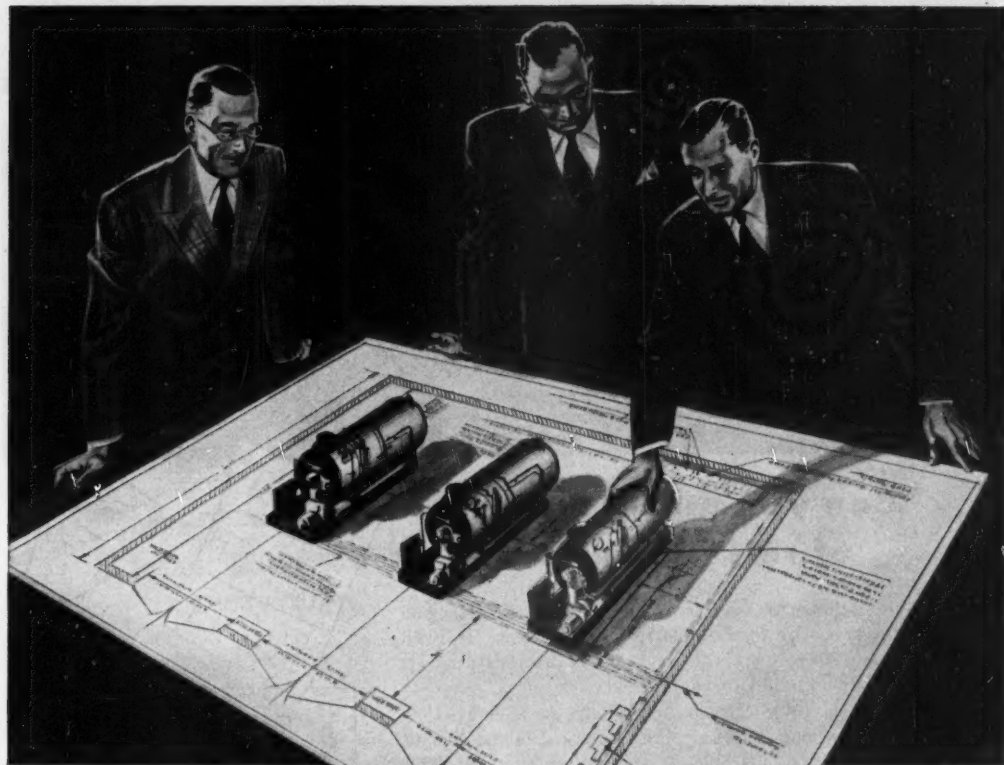


Fairbanks-Morse 1600-hp opposed-piston Diesel equipped with two Ross Exchangers: one for jacket water, the other for lube oil.



Fairbanks-Morse 2000-hp dual-fuel engine equipped with two Ross Exchangers for lube oil and jacket water cooling.

Plan Your Boiler Installation this Way..



...to Balance Load Factor with Low Investment
...to Meet Present Needs and Future Expansion...

CLEAVER-BROOKS self-contained steam boilers are the answer to both present and future steam needs. You can install Cleaver-Brooks boilers in units to fit your present steam capacity requirements . . . keeping your investment at a minimum and your boiler efficiency at a maximum. Here's how it works . . .

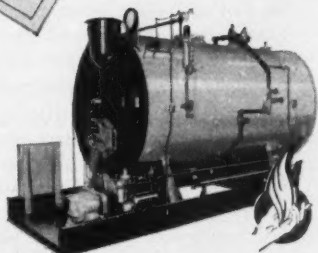
Your initial Cleaver-Brooks boiler installation is made in the size or capacity to fit your present steam load — this assures full use now at top efficiency and low capital investment.

As increased steam needs arise, additional Cleaver-Brooks boilers can be added to keep pace with your expanded requirements.

With this flexible program, you have the greatest return from your boiler investment — minimum original cost and lowest operating cost. Your boilers are always operating at maximum efficiency (80%) over the entire working range (30 to 100%).

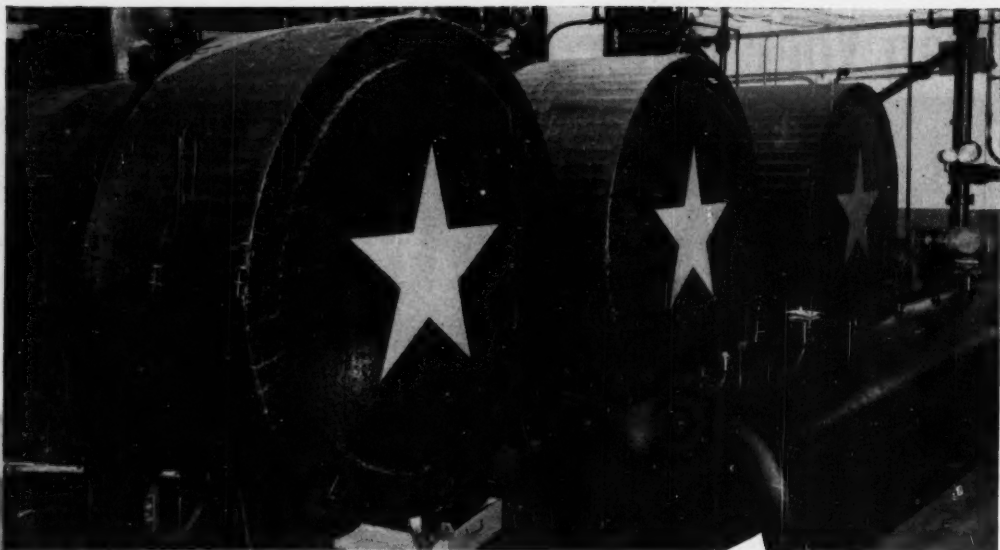
Cleaver-Brooks self-contained boilers are ideal for multiple installations because of their compactness, low headroom requirements, fast installation, automatic operation, range of sizes. Available in standard models—15 to 500 hp.; 15 to 250 psi; gas, oil or combination gas and oil fired units.

Get all the story — write today for latest catalog.



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Builders of Equipment for the Generation and Utilization of Heat • Steam Boilers • Oil and Bitumen Tank-Car Heaters • Distillation Equipment • Oil and Gas-Fired Conversion Burners




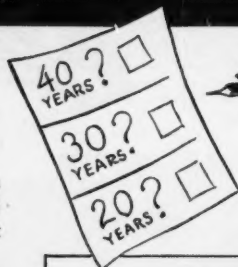
Can you guess the age of this insulation?

A good insulation job never looks its age. The cork lagging on these brine coolers, for example, seems almost new. It is still dry, highly efficient, and shows no signs of deterioration. Yet this insulation was installed in 1912—40 years ago!

These tanks are part of the equipment at the Memphis Cold Storage Warehouse Company. In that warm, humid climate, 6" of Armstrong's Cork Lagging has held temperatures of 12° below zero at remarkably low refrigerating costs. The lagging has proved its superior moisture resistance despite the wide temperature differential outside and inside the vessels. The only maintenance has been occasional inspection of the bands and periodic painting with asphalt paint.

It takes the right combination of sound engineering, top-quality materials, and expert application to give that kind of service. But when Armstrong's Corkboard, Lagging, or Cork Covering are used, records like this aren't unusual. Today, hundreds of cork installations across the country are performing efficiently after 20, 30, and even 40 years of service!

Low-temperature insulation is a long-term investment. That's why it pays to contact Armstrong whenever you're planning any insulation job. We offer a complete line of the finest insulating materials and the skilled workmen to apply them properly. You get an insulation job that gives years of economical, trouble-free service. For further information, just contact your near-by Armstrong office or write direct to Armstrong Cork Company, 3308 Concord St., Lancaster, Pa. 



Complete Insulation Contract Service

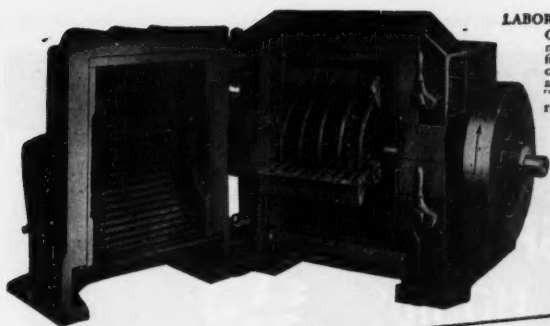
When you engage a contractor, you have a right to expect certain things that cannot be written into a proposal. These factors can largely determine whether or not the agreement will be entirely satisfactory. They include:

1. Financial responsibility — resources to complete the contract despite any unforeseen events.
2. Integrity — a reputation for quality work and for prompt settlement of any justified complaints.
3. Technical ability — experience, plus technical and research staff to complete the work in accordance with best practices.
4. Manpower resources — trained supervisors and workmen able to handle any contract efficiently.
5. Efficiency — ability to handle accurately things like accounting, tax provisions, insurance, and workmen's compensation.

**You get all these with an
Armstrong Contract**

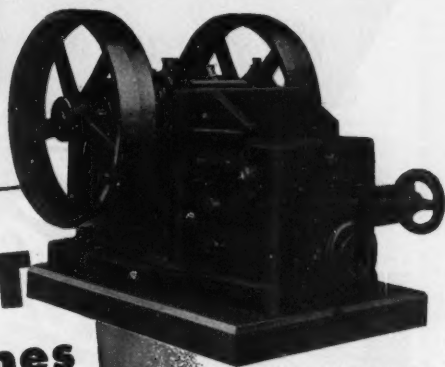
Armstrong's INDUSTRIAL INSULATIONS

For temperatures from 300° below zero to 2800° F.



LABORATORY SWING-SLEDGE MILLS

Capable of reducing soft, moderately hard and tough or fibrous materials to any degree of fineness between 1 in. and 20 mesh. The patented "Open-Door" feature permits ready accessibility for cleaning.

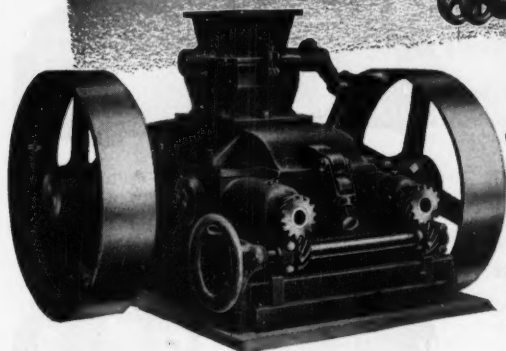


LABORATORY JAW CRUSHERS

Special Roll Jaw action simplifies close regulation of the product with capacities varying from 300 or 400 lbs. per hour at finest settings, to 1000 or 2000 lbs. when opened for coarser work. Each part of the crusher is accessible for quick and easy cleaning.

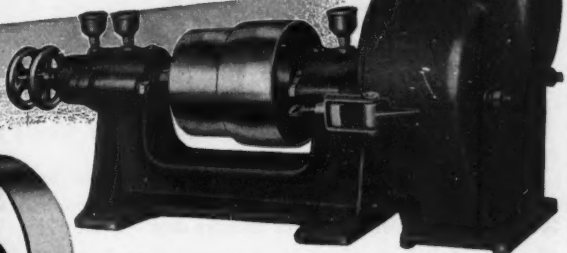
STURTEVANT Laboratory Machines

Assure Quality of Products
Fast - Economical - Accurate



LABORATORY CRUSHING ROLLS

First designed especially for laboratory sampling work, Sturtevant Crushing Rolls are used regularly in many plants where there are limited outputs. Range of output for the 8 x 5 size is from 1/2 in. to 20 mesh — and for the 12 x 12 size from 3/4 in. to 20 mesh.



LABORATORY SAMPLE GRINDER

Laboratory Sample Grinders are of the "Open-Door" disc type and are capable of very fine work, producing products as fine as 100 mesh (coarser if desired) when working on dry, friable, soft or moderately hard materials. Simply turn hand wheel to provide product regulation from 10 to 100 mesh.

The only sure way to maintain strict quality of products is laboratory control . . . and that calls for accurate sampling.

Sturtevant Laboratory Equipment meets the exacting requirements of laboratory work. They are fast and accurate . . . provide true samples.

Rugged and dependable, Sturtevant equipment actually has all the features

of full size machines plus extra accuracy and wider range of adjustment. The "Open-Door" accessibility permits quick, thorough cleaning . . . prevents the possibility of previous batches from contaminating new samples.

Investigate Sturtevant equipment for your laboratory. It will cut your sampling costs . . . help maintain strict quality of products . . . increase sales. Write for complete details and catalog.

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Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

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the Hazard of

**SPLASHING
LIQUIDS**

WITH

Century SPLASH PROOF MOTORS

Keep the vital parts of your motors dry—even when the full force of a hose is turned directly on them. Century Splash Proof motors eliminate production losses due to dripping or splashing liquids or falling solids. They also protect against rain, snow, sleet or hail on outdoor installations.

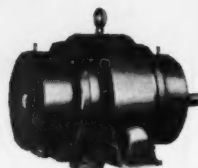
Century Splash Proof motors are available in a wide range of types and sizes for all popular applications. Other types and ratings are available to meet your electric power requirements. You can specify Century motors with confidence.



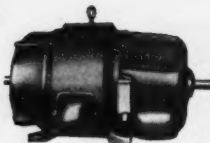
Century 7 1/2 HP Type RS Single Phase Repulsion Start Induction Brush Lifting Splash Proof Motor.



1 to 7 1/2 HP Direct Current Splash Proof Motor.



150 to 400 HP Type SC Squirrel Cage Induction 3 Phase Splash Proof Motors.



30 to 100 HP Type SR Slip Ring Induction 3 Phase Splash Proof Motors.



1 to 125 HP Type SC Squirrel Cage Induction 3 Phase Splash Proof Motors.



3 to 25 HP Type SR Slip Ring Induction 3 Phase Splash Proof Motors.



1 to 20 HP Type CS Capacitor Start Induction Single Phase Splash Proof Motor.

Century motors are built in sizes 1/8 to 400 horsepower.

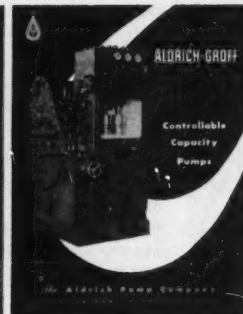
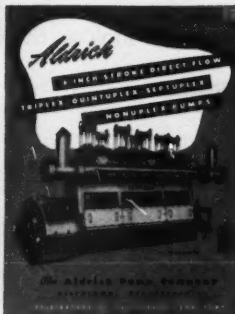


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For Men Who Specify, Buy or Use Reciprocating Pumps


☐ 10 to 50 hp

☐ 50 to 275 hp

☐ 300 to 900 hp

☐ 5 to 125 hp

Tear out this page NOW and send for these Aldrich Data Sheets

These 2-color data sheets give full details of design and construction, including dimension and sectional drawings, performance data and pump specifications.

Aldrich Pump Applications

... include handling of caustic solutions, fatty acids, nitric acid, acetic acid, aqua ammonia, anhydrous ammonia, and liquids encountered in petroleum refining, petro-chemical, and other industries.

CHECK THE ONES YOU WANT—ONE OR ALL !

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CHEMICAL ENGINEERING—August 1952

HOW TO FIGURE THE COST OF STEAM TRAPS

STEAM TRAPS are something like wives. First, there is the cost of securing one and installing it in its new home. Then, there is the cost of maintaining it. Now, everyone knows that some wives are frugal and help their husbands a great deal, while others are frivolous spend-thrifts. It is the same way with steam traps. You have to figure the original installed cost, the maintenance cost and the effect on general operation.

Divide the total expenses by life of the trap and you get down to the real heart of the matter—the *cost per year*. This is where Armstrong steam traps really shine! Let's take a look at the details:

DIRECT TRAP COSTS




1. First Cost. The price of Armstrong traps is low in terms of capacity. An optimum relationship between leverage, bucket weight, bucket travel and orifice size gives big capacity in a small package. Armstrong steam trap capacity ratings are based on actual tests with condensate at steam temperature and with actual hookups. They tell you what the trap will deliver *on the job*. This is not generally the case with other trap ratings.

2. Installation Cost. In four of the most widely used sizes, Armstrong traps are available in either side inlet—side outlet or bottom inlet—top outlet body styles, making possible the simplest, lowest cost installation.


3. Maintenance Cost. 40% less maintenance with Armstrong traps is the average of all the maintenance reduction reports secured from users over a period of years. This is due to high quality of parts, generous safety factors and inverted bucket know-how.

4. Repair Parts Cost. Armstrong heat treated chrome steel valve parts, precision ground and lapped, last a long time. When they do require renewal, a complete new valve mechanism right off the factory production line transforms an old trap into a new one at low cost.


INDIRECT COSTS



1. Cost of Steam Waste. This cost occurs through leaky trap valves, through traps that stick open or lose prime, through extra hours of operating heat transfer equipment due to poor drainage. This is a cost you can eliminate with Armstrongs.



2. Cost of Efficiency Losses. Poor trapping cuts heat transfer efficiency. Figure how much 10% loss affects the return on a \$5000 production unit, or a \$1,000,000 plant. Armstrong traps discharge condensate and air as fast as it accumulates, keep steam equipment at peak productive efficiency.



3. Cost of Downtime. Armstrong traps stay on the job long and faithfully, eliminating the production losses caused by excessive downtime for maintenance.

A steam trap casts a mighty big shadow that is multiplied by the number of traps in a plant until it has a major effect on operating costs. When you figure the costs from all angles you will find it pays to specify "traps shall be Armstrong."

FREE: STEAM TRAP BOOK

—44 pages of prices, design, selection, installation and maintenance data on Armstrong steam traps. You are welcome to a copy. Call your local Armstrong Representative, or write.



ARMSTRONG MACHINE WORKS

858 Maple Street • Three Rivers, Michigan



ARMSTRONG

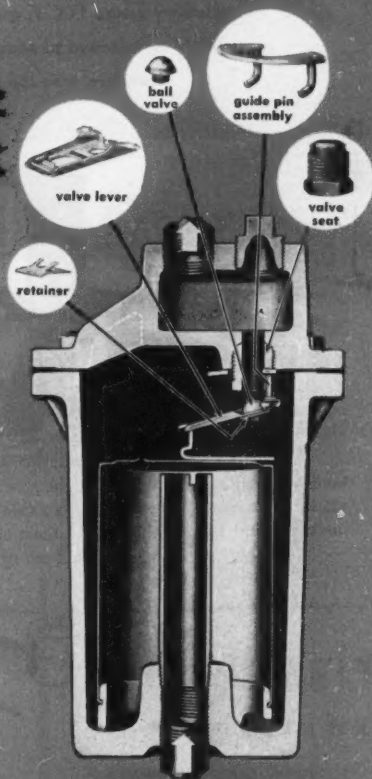


YOU CANNOT BUY A BETTER TRAP THAN AN ARMSTRONG...

Here Are Some Questions for Cost Comparison

1. Will the valve stay steam-tight for 2 to 3, or even up to 10 years depending on the service?
2. Will the trap discharge condensate at steam temperature to keep equipment hot and minimize non-productive radiation losses?
3. Will the trap automatically discharge air in sufficient volume to keep equipment at peak temperature and to prevent corrosion?
4. Is there enough safety margin of power in the bucket and lever to open the trap when the orifice enlarges slightly due to wear?
5. Can the trap stick in open position?
6. Is the trap apt to lose prime?
7. Are the published trap capacity ratings accurate and reliable for trap selection purposes?
8. Will the trap cleanse itself of ordinary dirt and scale?
9. Is the trap easy to install, inspect and repair?
10. Is the trap unconditionally guaranteed to give complete satisfaction?

If the trap is an Armstrong, the answer to each of these questions is favorable!



STEAM TRAPS

COST LESS!

when quality is a must...

Second to none are the A.C.F.-built Tank Cars, storage tanks for compressed gases, safety valves and processing vessels. A superior corps of highly skilled craftsmen and the world's most modern equipment for fabrication, inspection and testing assure unmatched standards of safety.

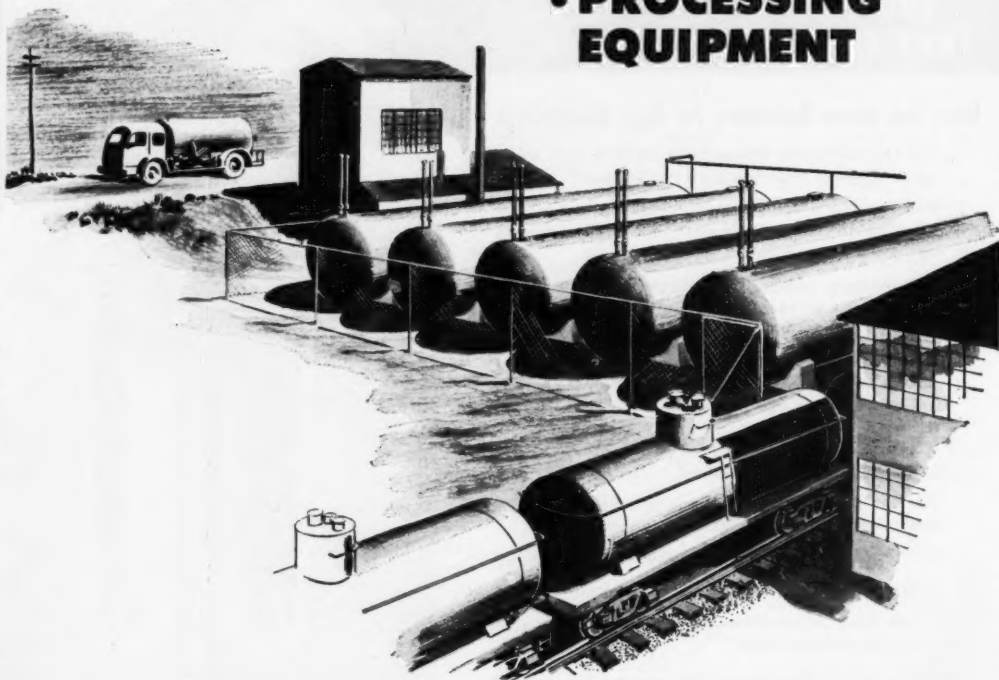
X-ray inspection and complete stress relieving insure A.C.F. quality.

We'll be pleased to send you literature with the facts.

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It's the **SHOT-PEENED** rollers that give your roller chain extra life!

... one of the extra-wear features you get with every **LINK-BELT** Roller Chain

POWER-TRANSMISSION engineers and metallurgists agree—shot-peened rollers mean longer roller chain life. That's just one of the engineering extras you get with Link-Belt Precision Steel Roller Chain. Another is Link-Belt's exclusive lock-type bushing.

Remember, too, Link-Belt's rigid material selection and controlled heat treating assure chain uniformity... no weak members.

Link-Belt builds a complete line of roller chain—single or multiple widths in $\frac{3}{8}$ " through 3" pitch; and double pitch, 1" through 3". Submit your chain problems to the Link-Belt office near you.



No partial bearing here
—bushing fits securely

Lock-type bushings increase ability to withstand severe operating conditions

A special manufacturing process securely locks the inside sidebars on the bushing, preventing lateral movement of the sidebars and eliminating a common cause of stiff chains. This Link-Belt development is applied on roller chains through 1" pitch and double pitch roller chains through 2" pitch.

LINK-BELT
Precision Steel Roller Chain

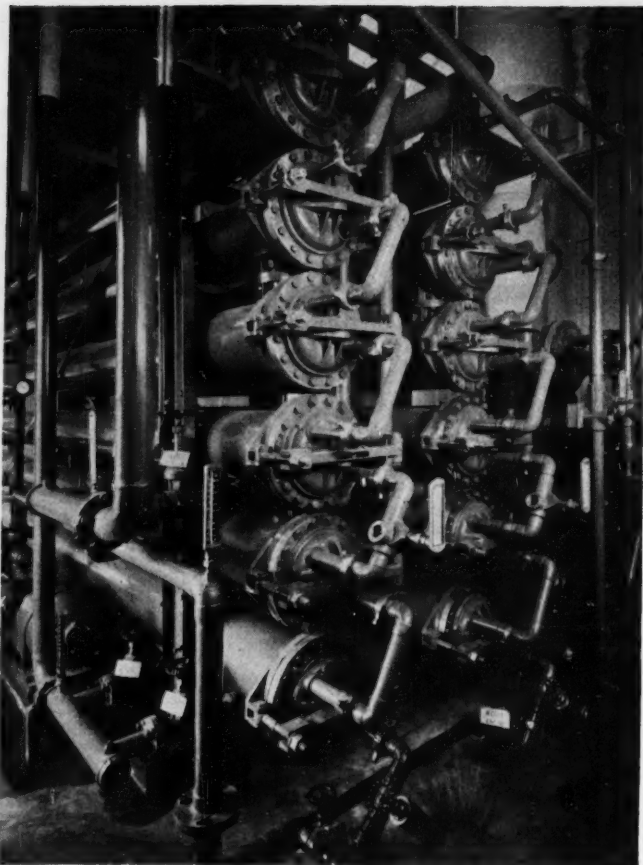
LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa), Sydney (Australia). Offices, Factory Branch Stores and Distributors in Principal Cities. 10,000

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have a beer?



**This Hot Wort Cooler
Handles 130 GPM →**



HOT WORT is beer as it comes from the kettle, before fermentation. In this cooler in the Blitz-Weinhard Brewery wort is rapidly brought down from 200° to 45°.

—and economical Anaconda Copper—traditional brewer's metal
—makes it highly efficient and insures long life

There was good reason to choose ANACONDA Copper for this heat exchanger made by Enzinger Union Corporation, Angola, N. Y., for the Blitz-Weinhard Brewery, Portland, Oregon. Copper is friendly to beer and will not corrode; it costs less, yet cools faster because it has a higher heat transfer rate than other metals. In this cooler not only the inner tubes, but also the outer shells are made from hard-drawn copper. The inner tube surfaces of copper may be economically cleaned by forcing brush-balls under pressure

through the inner tubes, which are connected in series.

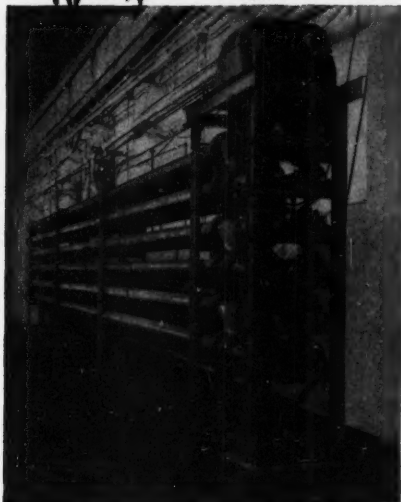
In chemical processing, selection of the right metal and the right alloy determines economy of operation and length of service life. For no one metal or alloy is best for *all* conditions. If you have a specific application in mind, consult our Technical Department. Their experience in brass and copper is over a century old . . . and is at your disposal. Write to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

82188

for efficient heat transfer **ANACONDA[®]** heat exchanger tubes



Keep Heat Transfer Surfaces CLEAN...



*DOUBLE PIPE UNIT. Drive end close-up of 12 section unit under test in our shop.



*SHELL and PIPE UNITS. Two of five units installed in a leading petroleum refinery.

*Patented

SPECIFY **Vogt** SCRAPED SURFACE *Exchangers*

If you are all "gummed up" with a tough heat transfer problem, Vogt Scraped Surface Exchangers will provide the answer. They have patented scraper elements which prevent fouling of the heat transfer surfaces and insure the highest rate of heat exchange between the product and the cooling or heating medium. The scrapers also continuously agitate the fluid and assist removal of solids from the unit.

DOUBLE PIPE EQUIPMENT is available in two types; EXCHANGERS, for cooling with water, brine, and cold filtrate, and for heating with steam or hot liquids; and CHILLERS, for use with volatile refrigerants such as ammonia, propene, and Freon. Both types have 8" jacket pipes and 6" inner pipes with scrapers.

SHELL AND PIPE TYPE UNITS are designed for use with volatile refrigerants and for heating fluids with steam or similar heating mediums. They consist of large welded shells each containing seven 6" scraped pipe sections.

Vogt Scraped Surface Exchangers serve profitably as oil chillers, crystallizers, and heaters in many processes in the petroleum and chemical industries. Their application to your heat transfer problems will receive the prompt attention of our Engineering staff.

Write for Bulletin PE-1.

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Piccoumaron

Para-Coumarone-Indene

RESINS

Piccoumaron Resins are soluble in coal tar, turpentine, terpene and most chlorinated solvents. Colors vary from pale yellow to deep reddish brown. Good resistance to acids, alkalies and salt. Available in grades from liquids to brittle solids.

Write for samples and complete data on PICCOUMARON Resins.

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Plants at: Clairton, Pa.; West Elizabeth, Pa.;
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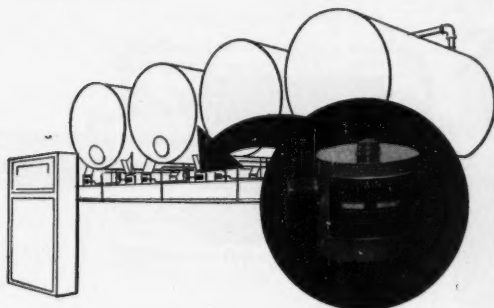
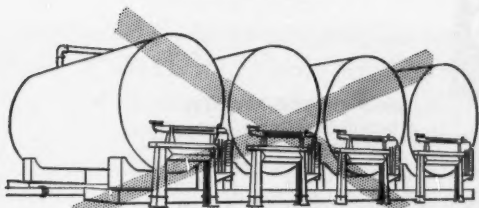


Distributed by Pennsylvania Fork Chemical Co., Pittsburgh 30, Pa.
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SR-4® DEVICES

*can solve these problems . . .
and many others . . . for you!*

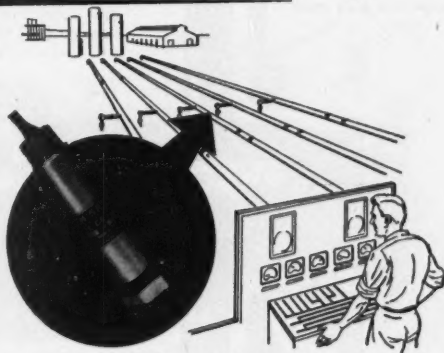
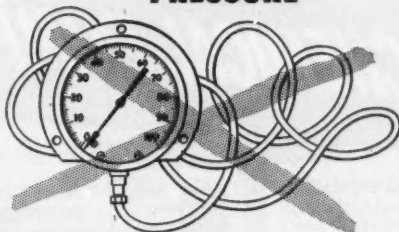
WEIGHING



Baldwin SR-4 Load Cells bring new simplicity, sensitivity and reliability to measuring and batching liquids by weight. Cells may be located under existing supports, require small headroom, and record without appreciable movement of the sensing element. As units are completely sealed, cleaning is simplified, and corrosion and deposits no problem.

The indicating, recording or control instrument may be located at any convenient point, and used to report the weight of material in any number of tanks or hoppers. Elimination of pitting and multiple parts cut costs.

PRESSURE



Baldwin SR-4 Pressure Cells provide an accurate, economical means of measuring, controlling or monitoring fluids and gases. Cells may be placed at any desired location, and through electrical connections will "report-in" continuously to a remote central point. Another important application is in research, as the cells provide an unusually accurate means of measuring ultra-high pressures, surges, and explosion waves. Hysteresis and inertia effects are virtually abolished.

**IT'S ECONOMICAL!
SIMPLE! DEPENDABLE!
ACCURATE!**



HEART of all SR-4 measuring devices is an SR-4 strain gage which consists of a postage-stamp-sized grid of very fine wire.

This grid is cemented to the inside of the SR-4 device or, in strain analysis work and other types of measuring, directly to the piece under test. Changes in the load applied to the testing device (or test piece) change the electrical resistance of the wires in the grid.

By using a simple potentiometer or a Baldwin SR-4 Wheatstone Bridge Control Box, minute changes in pressure, weight, torque, etc., can be determined easily, inexpensively and with unusual accuracy.

If you have any measurement problem, it will pay you to investigate the unusual advantages of SR-4 strain gages and measuring devices.



BALDWIN-LIMA-HAMILTON

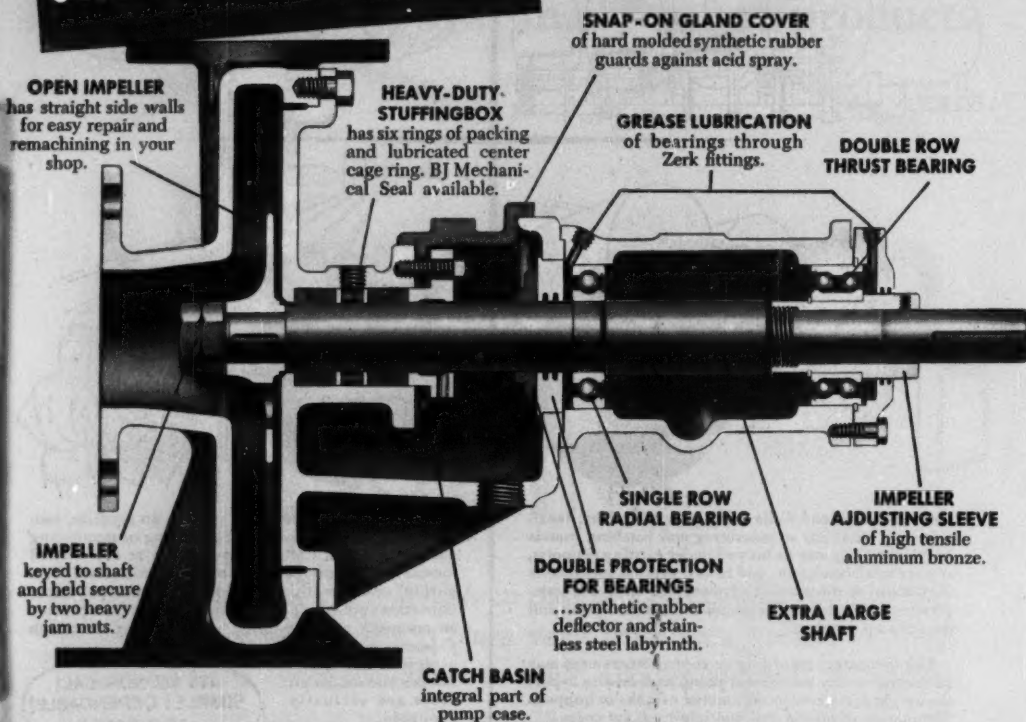
TESTING HEADQUARTERS

BALDWIN-LIMA-HAMILTON CORPORATION • EDDYSTONE DIVISION, PHILADELPHIA 42, PA.

IN CANADA: PEACOCK BROS., LTD., MONTREAL, QUEBEC

NEW BJ CHEMICAL PUMPS

Here are chemical



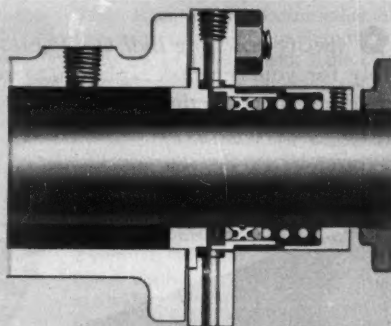
**You've asked for them...
now BJ introduces these
special construction features!**

- *Quick and easy dismantling* for inspection and repair without disturbing piping or driver.
- *All parts interchangeable* except pump case and impeller. Four different pump sizes can be used on one basic stuffingbox and bearing bracket assembly.
- *Corrosion-resistant catch basin*—integral part of pump case—guards bearing bracket and base plate from corrosive leakage.
- *Adjusting sleeve* permits compensation for impeller wear—allows easy adjustment without dismantling.
- *Grease lubrication* gives bearings greater protection against acid fumes. Deflector and labyrinth provide double protection against liquid entrance.
- *Cored passages* through impeller web keep stuffingbox under suction pressure.

pumps engineered to your demands...

You—the chemical pump user—dictated the design of these new BJ Chemical Pumps. Before Byron Jackson engineered these new BJ models, chemical pump users were asked what features were wanted most. Now these improved features are yours in the new BJ Chemical Pumps. Four pump sizes are available (1", 1½", 2" and 3") with capacities to 450 gpm and heads to 100 feet.

BJ Mechanical Seal also available for protection against leakage. BJ's Type "A" Mechanical Seal is designed especially for the particular demands of chemical pumping. It replaces the packing and provides positive protection against leakage to the bearings or contamination of the pumped liquid. All major parts of this BJ-designed seal are effectively isolated from contact with pumped liquid. Available as special construction, the BJ Mechanical Seal will save you maintenance time and money by eliminating frequent repacking.



YOU BENEFIT FROM MAXIMUM INTERCHANGEABILITY OF PARTS!

All parts except pump case and impeller are completely interchangeable. Four different size BJ Chemical Pumps fit one basic assembly! This means that only a few spare parts are needed to service a wide range of pumps.

FOR MORE INFORMATION
on these new pumps, write
BJ Chemical Pump Dept. 5.

BJ makes a complete line of centrifugal pumps to answer your other pumping needs.

Byron Jackson Co.

Since 1872

P. O. Box 2017 Terminal Annex, Los Angeles 54, Calif.

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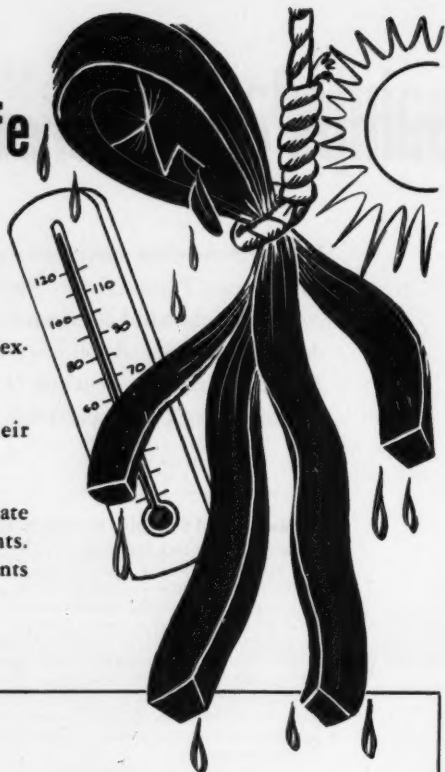
How to get More Life out of V-Belts

(STORAGE)

DON'T store V-Belts in a hot dry room or expose to the direct rays of the sun.

DON'T hang belts in such a way that their shape will be distorted.

DO specify and store *Bull Dog V-Belts* in adequate supply for your normal replacement requirements. With Bull Dogs on the job "normal" replacements are few and far between.



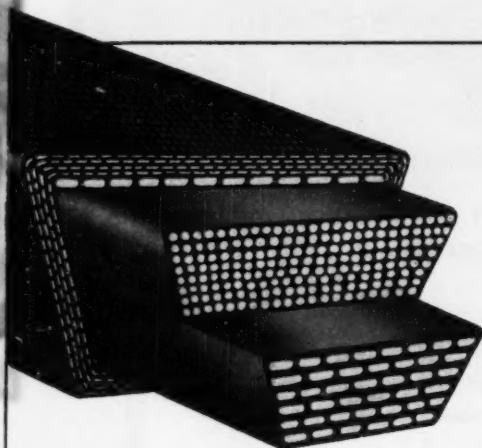
HERE'S WHY

Their **DURABLE COVERS** withstand the severe wearing action of the sheave while sealing the belt against grease, dirt, moisture.

There's **MINIMUM STRETCH** due to a new, exclusive technique which results in fewer takeup adjustments, reduced slippage, longer belt life.

There's a **STRONG, SPECIALLY ENGINEERED CORD SECTION** with high tensile strength, increased load carrying capacity, ability to absorb shock loads.

The belt **TAKES HEAVIEST FLEXING** because BWB quality-controlled compounds run cooler and do not crack or deteriorate under severe flexing.



Your BWB distributor will be glad to show you how Bull Dog V-Belts have the covers, the cords and the compounds to cut your belting costs. Call him today.



Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Warehouse Stock: 111 N. Canal St., Chicago, Illinois Distributors in all Principal Cities
PLANT: CAMBRIDGE, MASS. • P. O. BOX 1071, BOSTON 3, MASS., U. S. A.

DREW TECHNICAL PRODUCTS

Drew produces more than 20 Fatty Acids to volume to meet the specific demands of manufacturers in many fields. Years of close study of Fatty Acids, plus modern research and fractionation techniques, also concerned give you a product just to their Fatty Acids.

LAURIC ACID FOR SHAMPOOS, SOAPS, SHAVING CREAMS, COSMETICS



DREW LAURIC ACID, distilled, fractionated and stabilized to safeguard color on prolonged heating. Formula ABL (70% Lauric Acid) is widely used in high grade cosmetic preparations, soaps, shampoos and shaving creams. Titre 30°C Minimum. Formulas AB, ABH and A are also popular in this field.

LAURIC ACID FOR WETTING AGENTS, DETERGENTS, INSECTICIDES



DREW AAB (85%-90% Lauric Acid). Distilled and fractionated to provide greater efficiency, better composition and superior color stability characteristics.

LAURIC ACID FOR ALKYD RESINS, FLOOR WAXES, PAINTS



DREW WECOLINE ABL. Distilled and fractionated coconut fatty acid with high lauric acid content. Shorter average molecular chain length and practically no degree of unsaturation. An ideal ingredient for alkyd resins due to its plasticizing efficiency and non-yellowing characteristics. Especially useful in formulations containing urea or melamine resins. A complete range of coconut fatty acid formulas: AB, ABH and A, are also available for use in the production of alkyd resins.

STEARIC ACID FOR METALLIC SOAPS and NON-IONIC EMULSIFIERS



DREW FORMULA 300—hydrogenated, distilled Stearic Acid (approximately 65%). High titre, low iodine value. Excellent color and mild odor. Permits manufacturers to obtain good, light color in finished products at nominal cost. Other grades of Stearic Acids also available up to 90%.

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DREW DP 520. More than a plasticizer: a versatile chemical used to impart flexibility, clearness, toughness, permanence in a wide variety of protein base products. Exceptionally stable against heat and humidity changes.

Drew Fatty Acids are, in many cases, both distilled and fractionated by a continuous process to reduce unsaponifiables, to keep color and odor forming bodies to a minimum, and when necessary to concentrate the unsaturated acids. When you specify **Drew Fatty Acids**, you pay only for the fractions that are best for your product.

*If you demand quality in your product, always insist on
Drew Fatty Acids. Write for complete reference book,
"Drew Fatty Acids", or phone us.*

TECHNICAL PRODUCTS DIVISION

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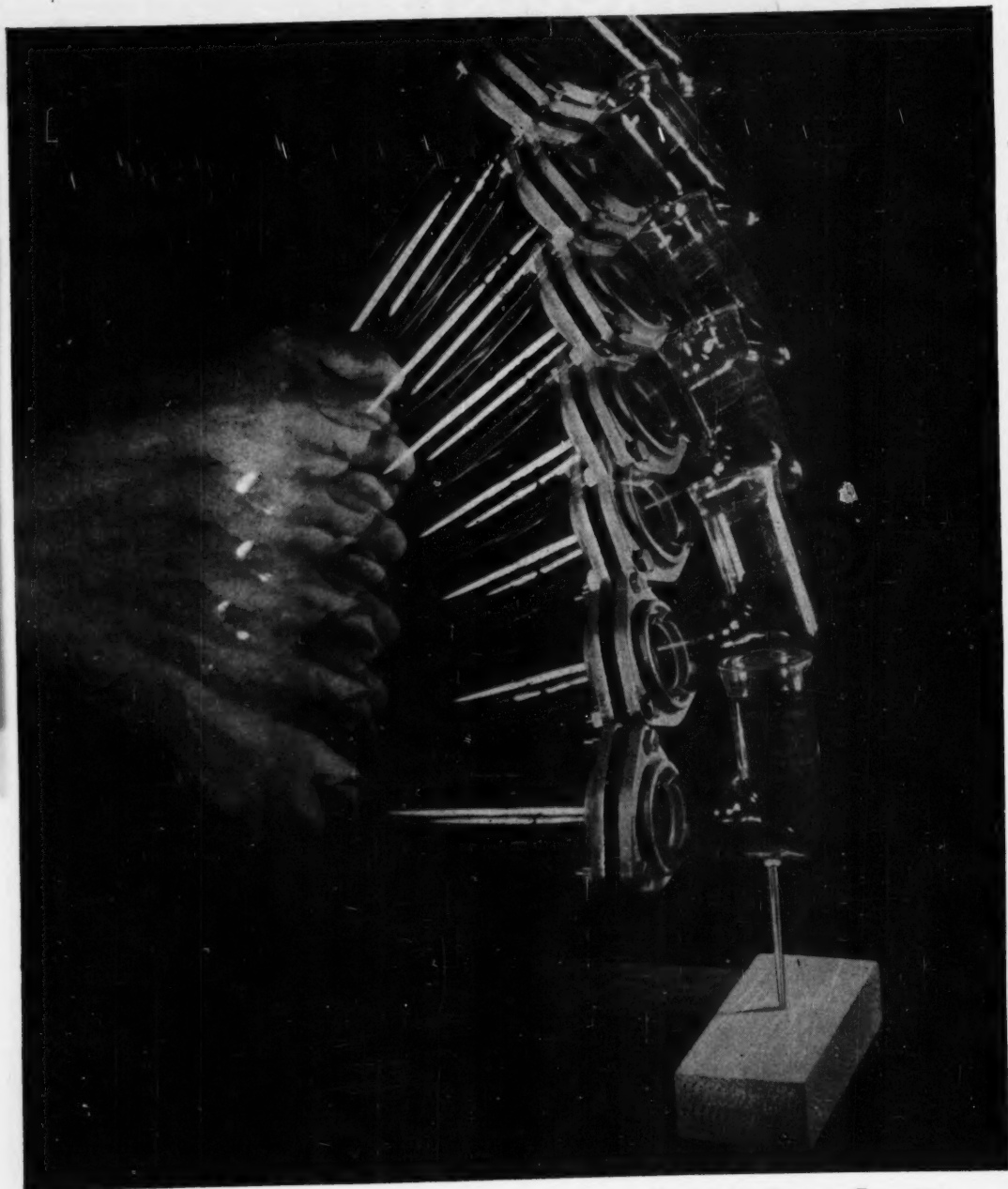
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Just how tough is PYREX[®] brand



"DOUBLE - TOUGH" glass pipe?

While PYREX pipe is no substitute for a hammer, it is $2\frac{1}{2}$ times stronger today than it was two years ago . . . hence, "DOUBLE-TOUGH."

Its resistance to thermal shock is such that you can use PYREX pipe at temperatures up to 450°F. and shock it 200°F. under full recommended operating pressure. You can even turn live steam into cold outdoor lines!

Mechanical damage is no problem either. First, because plant men respect glass . . . and this is based on 25 years experience. Second, because PYREX pipe can take a beating. Ends and fittings (except U-bends) are tempered to double their strength.

The corrosion resistance of PYREX pipe is its most outstanding property. It will safely and economically handle, hot or cold, mild alkali solutions and all acids except hydrofluoric.

But long service life with a minimum of replacement costs is only one of the reasons why more chemical plants are switching to PYREX pipe. They also like its transparency which permits them to check for cleanliness and to visually inspect the flow. They know trouble can't hide behind glass.

Drug and pharmaceutical manufacturers like PYREX pipe because it's non-contaminating . . . protects sensitive products. They also like its hard, smooth, nonretentive surface which permits easy cleaning and assures the cleanest surface known.

And ease and economy of installation and plumbing appeals to everyone because it cuts initial and maintenance costs and provides flexibility.

PYREX pipe is readily available in the following sizes—1", $1\frac{1}{2}$ ", 2", 3", 4", and 6" inside diameters. A complete line of fittings including ells, tees, crosses, reducers, laterals, return bends and caps may be had. Glass plug valves are available in 1" and $1\frac{1}{2}$ " sizes. There are a wide variety of gaskets now in stock to resist virtually every chemical known.

These PYREX brand glass pipe distributors stock the complete line:

ALBANY 5, NEW YORK
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Southern Scientific Co.

BELMONT, CALIFORNIA
Glass Engineering Laboratories

CAMBRIDGE 39, MASS.
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FRESNO 17, CALIFORNIA
Valley Fdy. & Mach. Works

HATBORO, PENNSYLVANIA
Sentinel Glass Company

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W. H. Curtin Company

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Fisher Scientific Company

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Fisher Scientific Company

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Scientific Supplies

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Stemmerich Supply Inc.

LODI, NEW JERSEY
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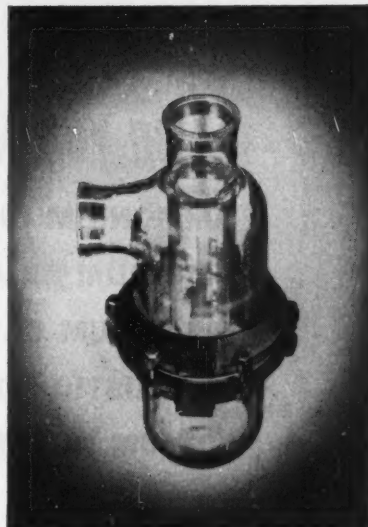
PYREX brand DOUBLE-TOUGH GLASS PIPE for Drainage Lines.

Where acids and other corrosives are being handled, you'll be sure of substantial savings by installing PYREX pipe drainage lines. One user reports that PYREX pipe paid for itself in his plant in less than nine months in saved replacement costs. Complete fittings are available. Adapter flanges make it a simple matter to join PYREX pipe lines to other types.



CORNING GLASS WORKS, Corning, N. Y.

Corning means research in Glass



PYREX brand Glass Sink Traps. This trap is nonsiphoning and permits easy cleaning. There's no plug to unscrew and the bulk of the water remains in the cap. Transparency permits rapid inspection. To assemble, simply use ordinary wrench to tighten.

CORNING GLASS WORKS

Dept. CE-8, Corning, N. Y.

Please send me the printed information checked below:

- ☐ "PYREX brand Glass Pipe in the Process Industries" (EA-1)
- ☐ "PYREX brand "Double-Tough" Glass Pipe and Fittings" (EA-3)
- ☐ "Plant Equipment Glassware for Process Industries" (EB-1)
- ☐ "Installation Manual" for PYREX brand "Double-Tough" Glass Pipe (PE-3)
- ☐ "PYREX Cascade Coolers" (PE-8)

Name

Title

Company

Street

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DO YOU NEED...

AMMONIUM CHLORIDE

AMMONIUM BICARBONATE

POTASSIUM CARBONATE

CAUSTIC POTASH

SODIUM NITRITE U.S.P.



See Solway First

For the dependable quality and uniformity of America's oldest and largest producer of alkalis and associated chemicals.

For delivery service from a strategically-located major plant and local stock points.

For a Technical Service that is operated on an industry-wide basis . . . providing expert advice to individual industries.

For a sales service that is handled by a staff of thoroughly trained, helpful salesmen operating from thirteen convenient branch sales offices . . . plus a nation-wide organization of selected jobbers, distributors and dealers.

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Set this "trap"



... for air impurities

● Because fresh air is of particular importance to the chemical process industries, the Dorex Air Pollution Test Unit has become a fixture in many plants. This inexpensive but amazingly accurate device tells what contaminants are in the air and in what concentrations.

It's all done with activated carbon. The Dorex Air Pollution Test Unit draws contaminated air uniformly through cylinders of special Dorex activated carbon. This traps all gaseous impuri-

ties. Then the Dorex laboratory analyzes the carbon, tells you what the contaminants are and the concentration of each.

With this information, you can easily set up the air purification system you need—for indoor comfort and quality control in your manufacturing, or for abatement of an outdoor nuisance.

Let us send you full information, without obligation. Just mail the coupon. W. B. Connor Engineering Corporation, Danbury, Connecticut.

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air recovery

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Dept. C-82, Danbury, Connecticut

Please send me, without obligation, full information about the Dorex Air Pollution Test Unit.

Name

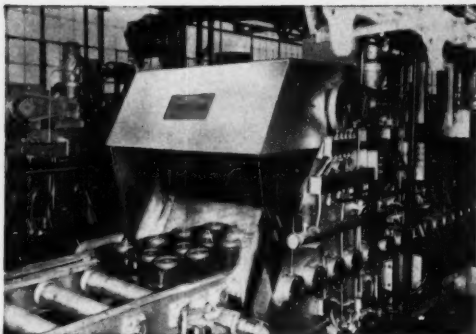
Position

Company

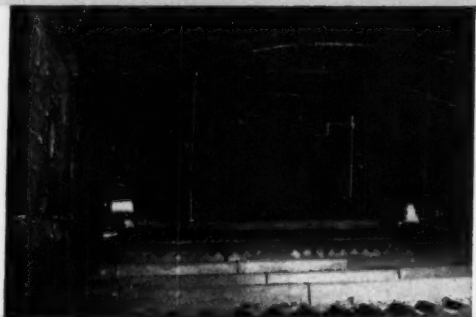
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City.....Zone.....State.....

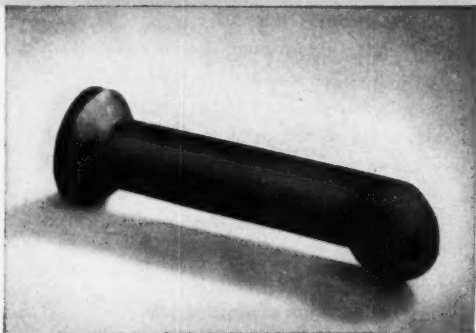
Looking for materials



Here is a high temperature, atmosphere furnace used for production brazing of automotive parts. These parts travel through on a cycle from cold, to 2100 F, to cold in 1 hour and 10 minutes. The fixtures holding the parts were formerly made of metal. These warped badly and the parts often stuck. Attempts to overcome the warping by increasing the thickness resulted in fixtures so heavy they absorbed a major part of the furnace heat and added to the load on the roller hearth. When replaced with Super Refractory fixtures, weight was sharply reduced, sticking was eliminated, and the new fixtures *outlasted the alloy about 5 to 1*. The Super Refractory fixtures, of course, cost much less, too.



This is a walking beam furnace (gas fired to 2000-2200 F) in which the bars being heated are periodically lifted and moved from one notch to the next. Step by step, they're walked through to the discharge end. The scalloped work-rests were originally made of alloy. These lasted 4 to 6 months, and almost every week the furnace had to be shut down to repair and straighten these rests. However, when Super Refractory rests were installed, the furnace ran *for 2 years* before the rests required *any* attention. Another full year of uninterrupted service was then obtained with only about 10% replacement. What's more, the initial cost of these rests was less than half the alloy's cost.



An interesting application of Super Refractories where little heat is involved, is this spray nozzle for acids. This particular nozzle is approximately 17" long, and 4" in diameter. Nozzles of this type are used for a variety of different acids. A typical application is in a sulfuric acid plant where weak sulfuric acid is sprayed into an absorbing chamber. The temperature of the sprayed acid is only about 200 F, whereas the temperature of the gases being absorbed is much higher. Therefore, these nozzles have to be made of a material that will not only withstand chemical attack, but also take the shock of this sharp temperature gradient — a job that's made to order for Super Refractories.

Super Refractories by

CARBORUNDUM

Trade Mark

Refractories Division

The Carborundum Company, Perth Amboy, N. J.

"Carborundum" is a trademark indicating manufacture by The Carborundum Company

to replace alloys?

Great strength, plus resistance to abrasion, corrosion and heat, make Super Refractories ideal replacements for many heat resisting metals.

Possessing properties seldom associated with refractories, Super Refractories by CARBORUNDUM have proved superior to metals in many applications. They have been particularly valuable where critical chrome, nickel or cobalt alloys were involved.

For example, Super Refractories have replaced metals for such diverse applications as: skid rails, muffles, wire guides, radiant tubes, roller hearths, brazing fixtures, recuperator tubes, etc. In these cases, they not only released vitally needed metals but outperformed them (by lasting longer than the metals —

while also increasing the capacity of the equipment).

As you look over the properties of Super Refractories listed below, draw a mental comparison with your needs. Exactly what makes an alloy essential in this place, or that? Is it refractoriness? conductivity? abrasion? corrosion? strength? It's surprising how often you'll find Super Refractories inherently better — and far less expensive — than metals.

It will pay you to investigate these unique Super Refractories . . . now, before the metals cupboard is bare. Your problem will be given prompt attention.

THESE SUPER REFRACTORIES ARE IDEAL WHERE

HIGH HEAT IS INVOLVED. Super Refractories are very strong and durable—can be safely used at temperatures over 3000 F. Compare this with 25-12 chrome-nickel steel, for example, which loses strength rapidly over 1500 F. and cannot be used with safety above approximately 2100 F.

ABRASION IS PRESENT. Two types of Super Refractories are within one index point of diamond hardness! They are the toughest known materials for large scale commercial use. They will distinctly outwear metals—especially at furnace temperatures.

HEAT CONDUCTIVITY IS NEEDED. At elevated temperatures, one Super Refractory material conducts heat *almost as rapidly as chrome-nickel steels*. It's widely used in equipment involving heat transfer. There are also Super Refractories which are good insulators, particularly at high heats.

STRENGTH IS IMPORTANT. Super Refractories are generally very strong, and *retain* their strength at temperatures where metals become unusable. For example, the modulus of rupture of one composition averages 3100 psi, at 2460 F. No commercial tonnage refractories have greater strength.

CHEMICAL ACTION IS PRESENT. In general, most Super Refractories are either neutral or acid in nature—are widely used where chemical inertness is important.

SPECIAL SHAPES ARE INDICATED. Practically all Super Refractories are available in a variety of special shapes molded to close tolerances—including fitted joints, tubes, etc.

USE THIS BOOKLET TO CHECK UP. This new booklet contains an easy-to-read analysis of the principal characteristics of these unique Super Refractories. The coupon will bring you the story—or one of our engineers will be happy to talk over your problems. We believe it could be mutually profitable.



Dept. H-82
Refractories Div., The Carborundum Co.
Perth Amboy, New Jersey

Please send me your free booklet on the properties of Super Refractories.

Name

Position

Company

Street

City Zone State

Why not compress ammonia this new way?

Here's a new idea in ammonia compression. Do it with a Carrier Centrifugal Compressor.

You'll be able to handle more capacity in less space, at lower cost, with far less maintenance.

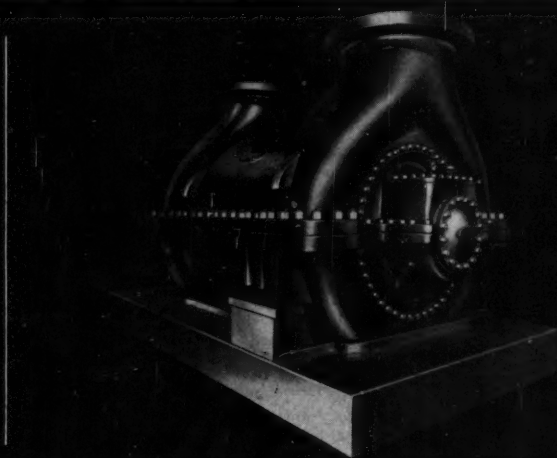
All-ferrous construction is standard on Carrier Centrifugal Compressors. Nothing need be changed to make them suitable for handling ammonia.

You can let Carrier Centrifugal Compressors handle the whole compression job. Or you can boost your capacity by connecting them with your existing reciprocating equipment.

Either way you can depend on Carrier to do the job right. Carrier has been making centrifugal compressors for 30 years. In that time, they have built over 2500 multi-stage centrifugals — far more than any other manufacturer. Carrier Centrifugal Compressors have handled more different gases than any other make, too. That's an example of the application skill that can pay off for you. Want more information? Write Carrier Corporation, Syracuse, New York.

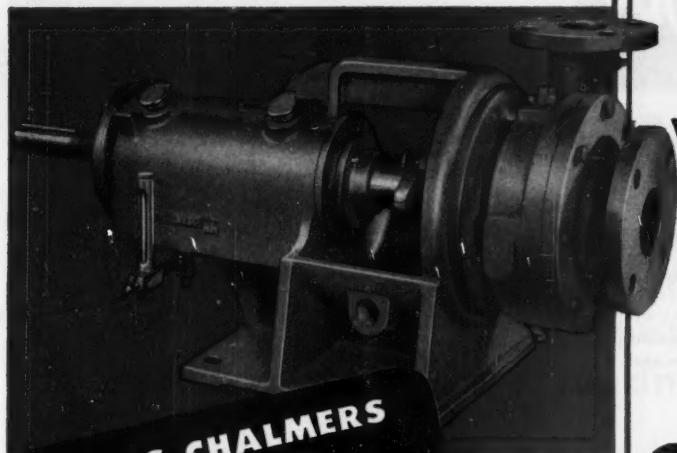
Carrier

CENTRIFUGAL COMPRESSORS
REFRIGERATING EQUIPMENT



Carrier Centrifugal Compressors, serving the leaders of world industry, are available in standard designs of from 2000 to 40,000 cfm, with from 3 to 7 wheels.

Before you order a costly "special purpose" pump...



ALLIS-CHALMERS
General Purpose
CHEMICAL PUMP

SEE WHAT THIS PUMP CAN DO!

If you can use this pump, you can save your plant hundreds of dollars.

FORMERLY, CHEMICAL MEN had to buy refinery type pumps for handling chemical solutions at 400 to 500 degrees F. There was nothing else to do the job.

Even today some engineers are surprised to find they can buy a general purpose chemical pump for pumping most chemical solutions.

There are several reasons why this Allis-Chalmers pump is able to handle so many chemical pumping jobs:

- Built in most used size range . . . to 1200 gpm, 250 ft head.

- Built for most used temperatures . . . for liquids to 500 F.
- Made with choice of materials . . . and choice of six different sealing arrangements, including a water cooled stuffing box . . . somewhat unusual in a pump of this type.
- Loaded with other features, including: large, easily changed reservoir of oil for lubricating the bearings; pedestal of rigid, corrosion resistant cast iron. In addition, there is plenty of room between pump and pedestal for easy maintenance.

Allis-Chalmers can supply you with a complete pumping unit — pump, motor, drive, and control — all of coordinated design and manufacture and all mounted on a rigid base ready to install.

To get more information on Allis-

Chalmers General Purpose Chemical Pumps, call your Allis-Chalmers Authorized Distributor or District Office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin for Bulletin 52B7638.

A-3648

Sold . . .

Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.



TEXKROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

Texkrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS



CHEMICAL ENGINEERING—August 1952

This was Lectrodryer's proposal for keeping a workroom DRY

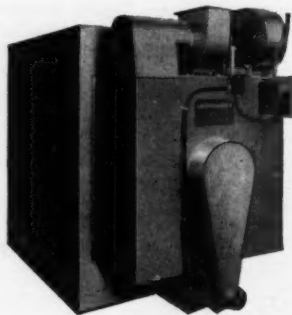
the Problem:

A room 16' x 15' x 10½' is to be held at 20% to 25% relative humidity at a dry bulb temperature of 85° F.

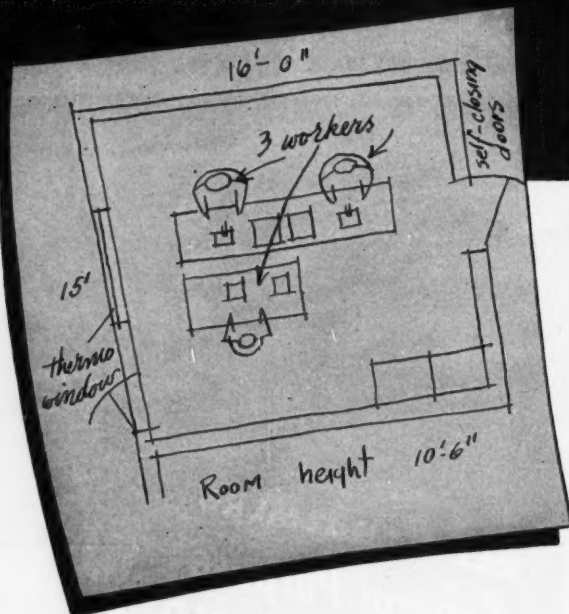
Three people will work in this area.
Materials processed give off no moisture.
Loss of air from the room will be small.

the Solution:

The Type CHG air-conditioning Lectrodryer*, capable of delivering 350 cfm of DRY air at 15° above temperature of the cooling water, with reactivation heat supplied by fuel gas, electricity or 110 psig. steam.



**LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS**



Lectrodryer engineers tell you exactly what equipment you'll need for dehumidifying an area, as they did in the actual case cited above. And, in addition, they advise on methods of sealing openings and walls against the intrusion of moisture—so necessary to hold down your operating costs.

Lectrodryers come to you fully assembled. You have only to connect up supply lines and ducts, and they're ready for work. If you'll tell us your humidity problem, we'll recommend a solution. Pittsburgh Lectrodryer Corporation, 303 32nd St., Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Edlington, Birmingham.
In Australia: Birlec, Limited, 51 Parramatta Road, Glebe, Sydney.
In France: Stein et Rouhaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Rouhaix, 320 Rue du Moulin, Bressoux-Liège.

LECTRODRYER

* REGISTERED TRADEMARK U. S. PAT. OFF.

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Controlled Quality

PIPE FITTINGS

maximum service
assured
by metallurgical
soundness

Sound metallurgy . . . the result of unsurpassed facilities and advanced laboratory controls . . . provides the maximum of dependability in Ladish Controlled Quality fittings. Every phase of metal quality . . . composition, structure and physical properties . . . is continuously safeguarded—and certified proof of metallurgical integrity is available to users of Ladish fittings.



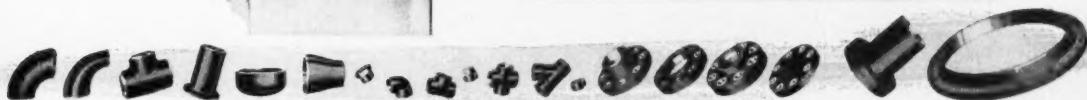
TO MARK PROGRESS

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

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Select **FOR ACCURACY...** **AND YOU'LL ALWAYS BUY** **AMERICAN DIAL THERMOMETERS**

Consistent accuracy — long-life service — have been associated with American Dial Thermometers for one hundred years! Every one is backed by the engineering skill and knowledge of materials, manufacturing and applications gained in more than a century of service to industry.

American Dial Thermometers are made in ranges from minus 60° to plus 1000°F. Selection is easy because we produce the greatest variety and offer the widest range of actuation in the dial thermometer business.

Mercury Actuation for rapid response, powerful action, extreme accuracy.

Vapor Pressure Actuation for accurate indication of temperatures at the most critical operating points.

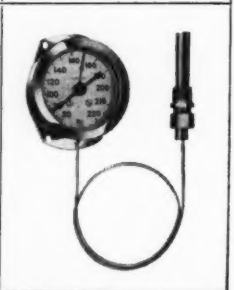
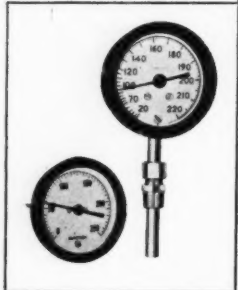
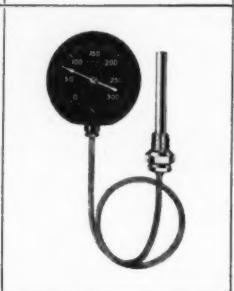
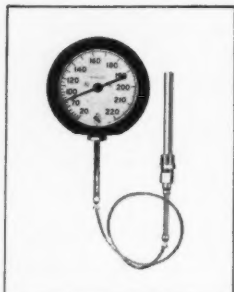
Gas Actuation for extremely high or extremely low temperature indications.

Bi-Metal Actuation for easy, fast, and economical installation.

Easy Readability — provided with clear, bold numerals, accurately graduated dials, and pointer of contrasting color.

Rugged Construction — stainless steel movements, climate-resistant cases, heavy cover glass fronts, unique flush mounting flanges.

New Catalog contains full details about the complete American line, including industrial glass, dial and recording thermometers; electronic temperature indicators and recorders. Write for a copy.



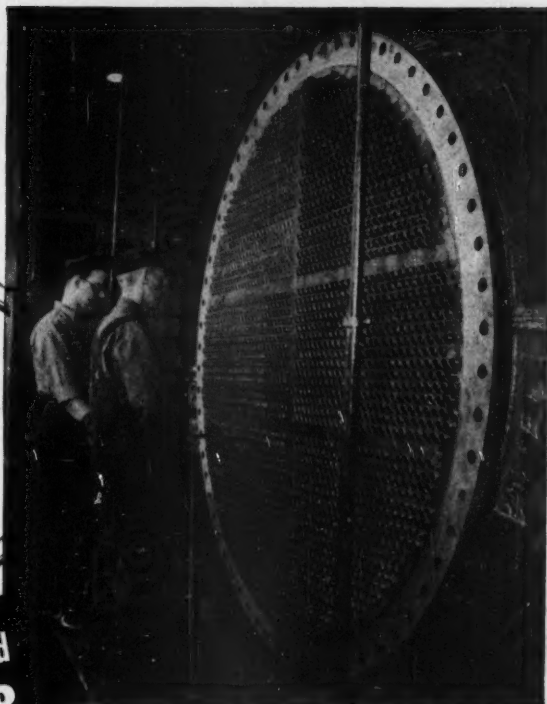
Pictured here are some of the many American Dial Thermometers stocked and sold by leading distributors.



AMERICAN INDUSTRIAL INSTRUMENTS

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT
 MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES. CONSOLIDATED
 SAFETY AND RELIEF VALVES. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND
 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.

Highly corrosive liquor will be handled in this surface condenser fitted with Republic ELECTRUNITE Stainless Steel Pressure Tubes.



**PULP and
PAPER**

**...another industry that cuts
costs with Republic**

ELECTRUNITE PRESSURE TUBES

Whatever the product you are processing in heat exchangers, take a tip from the paper industry . . . even at the most corrosive stages in their processes, they use Republic ELECTRUNITE Heat Exchanger Tubes.

Where highly corrosive liquids must be handled, Republic ELECTRUNITE Stainless Steel Tubes add years of life between retubings, cut per-year costs, keep processes uncontaminated, maintain production. Carbon steel tubes are available for less active liquids.

ELECTRUNITE Pressure Tubes in both analyses are uniformly strong all around and end-to-end . . . and uniformly corrosion-resistant. They are fully normalized to provide clean surfaces inside and out, to assure tight rolling-in and smooth bends.

Mark your next order for heat exchangers "Republic ELECTRUNITE Pressure Tubes" . . . make your next retubing job an ELECTRUNITE job.



**REPUBLIC
STEEL CORPORATION**
STEEL AND TUBES DIVISION
224 East 131st Street • Cleveland 8, Ohio



You get more than
just a valve—when
you specify **POWELL**

Here is what you get: First, a valve of finest quality materials and workmanship. Second, a valve that is exactly suited to the actual service conditions. And, third, the help of Powell Engineers in determining the right valve to solve any flow control problem you may encounter.

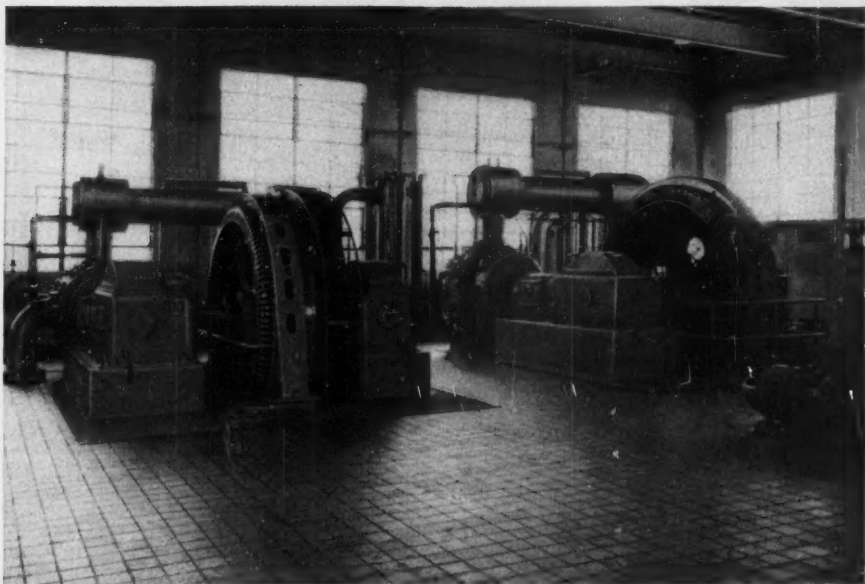
Fig. 1606. 100-pound
Bronze Globe Throttling
Valve. A Powell design
that permits full flow
through the seat when
wide open. Has special
bronze stem and stain-
less steel disc and seat.

The Wm. Powell Company
Cincinnati 22, Ohio

POWELL

BRONZE, IRON, STEEL AND CORROSION-RESISTING VALVES





meet AIR DEMANDS economically

with O-CE COMPRESSORS, built for continuous, heavy-duty operation — in sizes up to 2,000 hp., for pressures to 5,000 lbs.

Of horizontal, double-acting, water-cooled type, with direct-mounted synchronous motor drive, these compressors are unsurpassed for dependable, low-cost performance.

- ✓ Equipped with roller bearings throughout.
- ✓ Quick-acting Simplate valves minimize power consumption.
- ✓ Large, stream-lined air passages make air flow resistance negligible.
- ✓ CP Multi-Step Control handles partial load demands economically.
- ✓ CP Automatic Starting Unloader completely unloads compressor when starting and stopping, and permits automatic restarting after power failure.
- ✓ CP Intercooler assures maximum heat transfer with low water consumption.

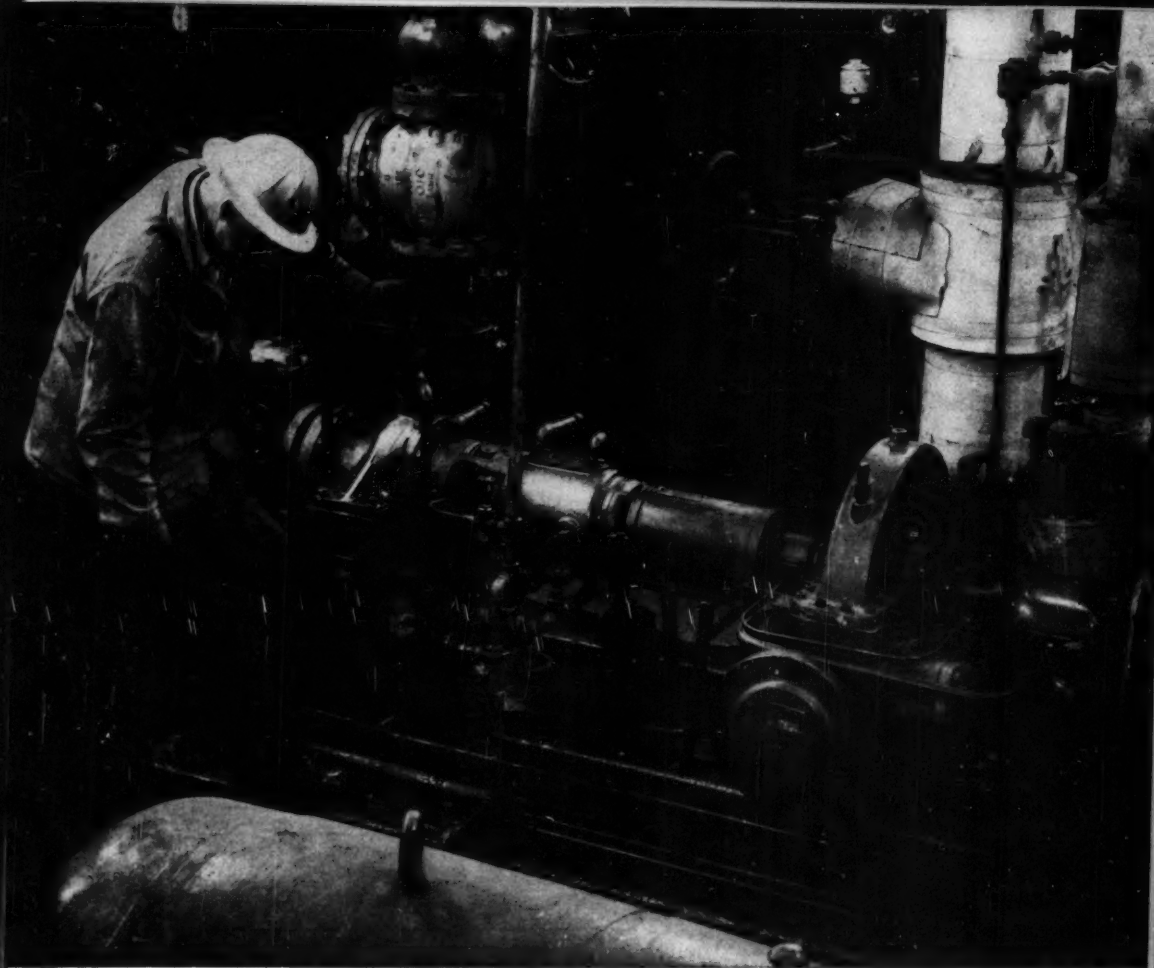
Write for full information.



**CHICAGO PNEUMATIC
TOOL COMPANY**

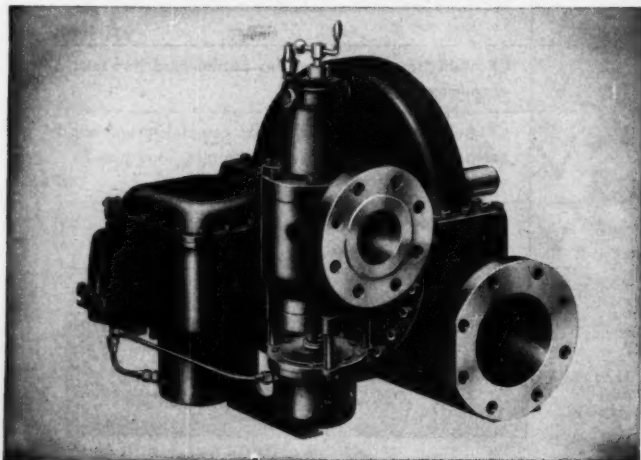
General Offices: 8 East 48th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



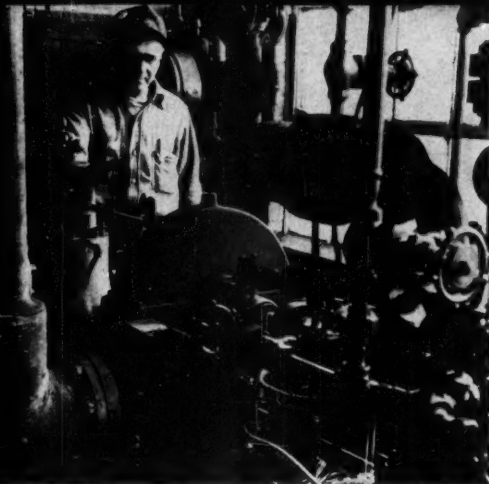
Mr. A. Bourgeois, process foreman at Sohio Refinery, adjusts pump valve. Type DP-20, 125 hp turbine increased by 75%

the oil thru-put of this pump which supplies crude oil for the distillation unit.



Type DP MECHANICAL-DRIVE TURBINE

This Type DP turbine is one of General Electric's line of mechanical-drive turbines designed for driving pumps, compressors, blowers, etc. Their sturdy construction and many safety features make them ideal for industries having process steam requirements.



At Sohio's Toledo Refinery, this 15 hp, Type DP-16 turbine with non-sparking enclosed overspeed governor, safely pumps propane in an explosive atmosphere.



Mr. Eugene Ten Eyck and Mr. E. J. Bissonnette of Sohio Refinery discuss stocking of interchangeable parts for the Type DP turbines installed at the Refinery.

Sohio Refinery picks G-E turbine drives to increase oil thru-put

Engineers at Sohio's Toledo Refinery installed two G-E mechanical-drive turbines to help eliminate a bottleneck in refinery operations. A General Electric Type DP-20 turbine increased oil thru-put on one pump at Sohio by 75%, when it replaced older drive equipment. Total daily thru-put of the one pump now equals the former capacity of two pumps.

INSTALLED IN HAZARDOUS AREA

Sohio also installed a G-E Type DP-16 turbine in an explosive atmosphere to pump almost pure propane. The enclosed, non-sparking overspeed governor and the positive trip-throttle valve (which shut off all steam flow in case of overspeed) reduce hazards in this area. The turbine, which operates twenty-four hours per day, has required no maintenance during its first year of service.

VIBRATION REDUCED

Replacement of previous drive equipment with a G-E turbine now assures longer life to other machinery

in the area. For G-E turbines with their center-line support and rigid assembly of buckets are now contributing to smooth operation at the refinery.

INTERCHANGEABLE PARTS

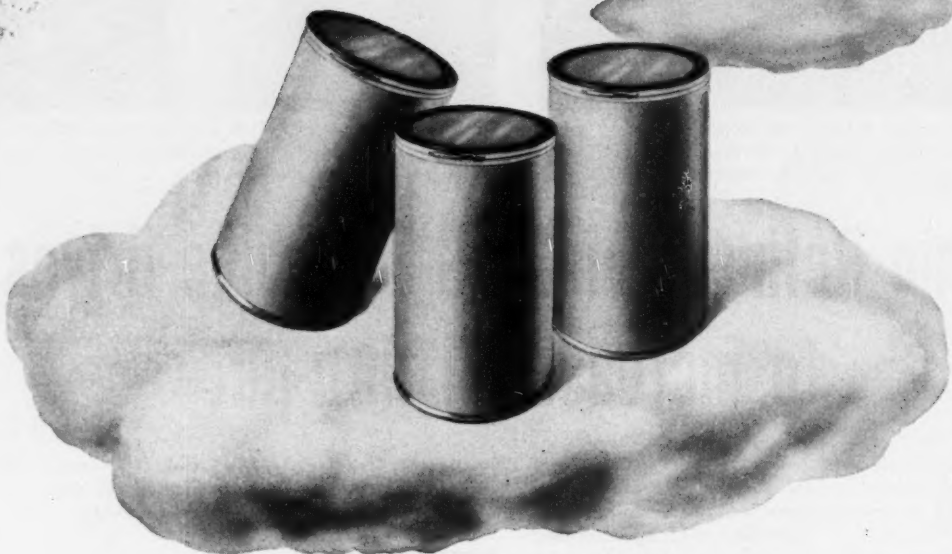
Use of G-E standard turbines can make stocking of spare parts a simple matter—most replacement parts are interchangeable among various frame sizes of G-E Type DP turbines. Stocking costs are cut, yet parts are available when needed.

This same parts standardization adds to the turbine's flexibility—often the turbine can be adapted to a new plant application with only minor adjustments. Horsepower range can be changed by substituting a different nozzle plate and valve parts.

For more information about the many advantages which these standardized turbines offer, call in your G-E sales-engineer or write for bulletin GEA-4955A, "A New Standard in Mechanical-drive Turbines." Section 252-56, General Electric Co., Schenectady 5, New York.

GENERAL  **ELECTRIC**

The light way to ship is in Continental Fibre Drums



These light-weight durable shipping containers are designed for real economy. They bring you appreciable savings on shipping charges — savings that can amount to substantial sums in the face of today's high freight rates. And they also save you worthwhile amounts on export shipments where import duties are figured on gross weight.

Continental drums are rough and sturdy. They stand up to the abuse of long freight hauls without splitting,

cracking or leaking. This means you can give expensive or dangerous materials adequate shipping protection at minimum shipping cost. Closures seal securely, yet go on and off easily.

These drums can be printed or paint sprayed to become colorful, effective "traveling salesmen!" Continental fibre drums are available in a full line of sizes, from 12 gallons to 75. Call or write your nearest office for complete details.

CONTINENTAL © CAN COMPANY
Fibre Drum Division
Van Wert, Ohio

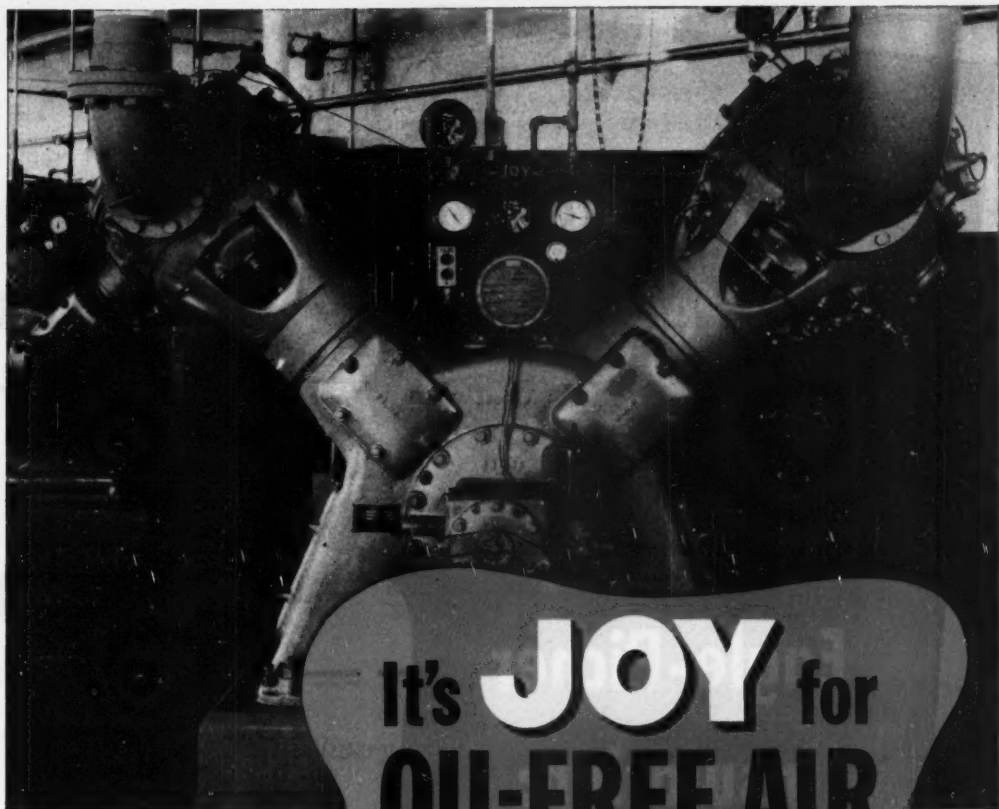
NEW YORK
CHICAGO

• PHILADELPHIA
• SAN FRANCISCO

• PITTSBURGH
• ST. LOUIS

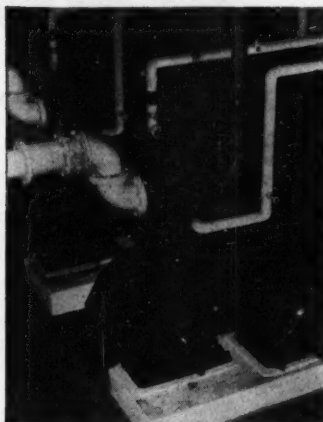
• TONAWANDA
• LOS ANGELES

• CLEVELAND
• EAU CLAIRE



Above: Joy WNO-112 Oil-Free Compressor

Below: Joy WGO-9 Oil-Free Vertical Compressor



Note some of the reasons why

- ★ Special lightweight pistons minimize wearing pressure on the rings.
- ★ Ease of disassembly facilitates inspection of pistons, rings, cylinder liners and valves.
- ★ On-the-job-replaceable chrome-plated cylinder liners for hard, smooth, friction-reducing surfaces, and field replaceable crosshead guides.
- ★ Carbon graphite compression rings designed to compensate automatically for wear.
- ★ Large, direct air passages and liberal water-jacketing reduce heat of compression and increase ring life.
- ★ Patented Dual-Cushion valves, all parts of which are made from corrosion-resistant materials.
- ★ All wearing areas, except carbon rings, are either chrome-plated, surface hardened, or of stainless steel.
- ★ Complete line of types and sizes of compressors to meet any capacity and pressure requirements. ● Let us quote on your air supply needs of any nature.

Consult a Joy Engineer

WAD 1 4047

Over 100 Years of Engineering Leadership



JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING • PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

Check the three
big reasons
why it pays
to specify
Eagle-Picher
Insulation:

1.

2.

3.



Eagle-Picher "66" Insulating Cement—

All-purpose, rust-inhibitive, super-adhesive insulating cement. Great coverage, extreme thermal efficiency with "Springy Ball" pellets which won't collapse after application. Easy trowel application over all kinds of surfaces. Efficient up to 1800 F... reclaimable where temperatures do not exceed 1200 F.



THE EAGLE-PICHER

Cost-cutting insulations of top thermal efficiency



Insulating Cements



Fireproofing Cements



Supertemp Block



Blankets



Insulseal

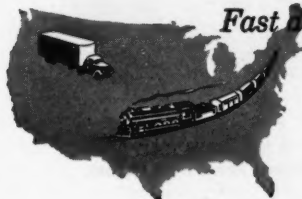


Stalastic



Dependable contractors, trained to strict factory standards

You can count on Eagle-Picher authorized contractors for uniformly high caliber service. Their qualifications provide assurance of a good job every time . . . efficient application of the Eagle-Picher insulation that best fits your needs.

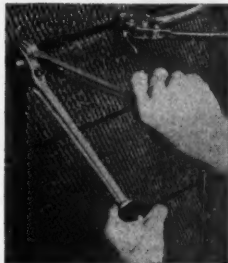


Fast delivery from strategically located distribution points

The Eagle-Picher insulation line is stocked by distributors and authorized contractors coast to coast. The one nearest you will be happy to recommend insulating materials that give your equipment highest thermal efficiency . . . reduce fuel costs . . . help provide precise temperature control.

Eagle-Picher Supertemp Blocks—

A real insulating block—not a refractory! Unequalled for insulating quality. Weighs approximately 22-24 lbs. per cu. ft. Cuts easily with knife or saw . . . fits snugly over contoured surfaces. Monolithic structure . . . high refractory value. Withstands temperatures up to 1700 F. All standard sizes, from 3" x 18" to 12" x 36" . . . in thicknesses from 1" to 4".



Eagle-Picher Mineral Wool Blankets—

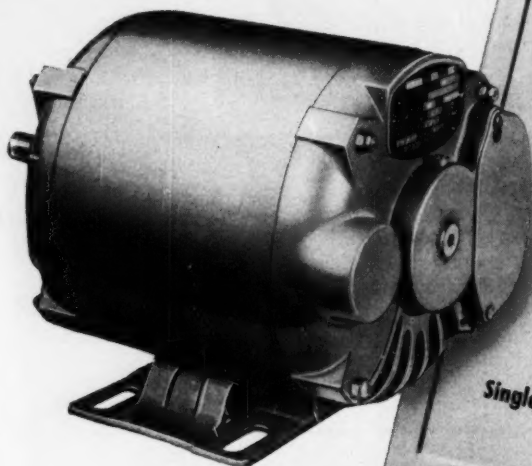
Made under factory supervision, these blankets fill your needs for fast, convenient insulating of flat or curved surfaces on larger types of heated equipment. The wool is felted and secured by flexible metal fabric . . . possesses outstanding physical and chemical stability for maximum resistance to water, steam, corrosive fumes and vibration.

COMPANY



General offices: Cincinnati (1), Ohio
Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.

INTRODUCING



In addition to its regular line of integral horsepower motors, ACEC now offers a wide range of fractional horsepower induction motors . . . thus enabling you to select just the *right* motor for your drive from one dependable supplier.

ACEC fractional horsepower motors are available as follows:

SINGLE PHASE 1/4 to 1 1/2 hp.
Capacitor Start—Open Drip-proof

THREE PHASE 1/4 to 3/4 hp.
Open Drip-proof
TEFC—Totally enclosed, fan-cooled
TENV—Totally enclosed, non-ventilated



All ACEC motors conform strictly to NEMA FRAMES AND SPECIFICATIONS. Products of skilled engineering and experienced workmanship, they are designed and built to give every possible satisfaction in service.

ACEC BRANCHES AND REPRESENTATIVES are located throughout the United States, and Service Shops, from coast to coast, fulfill the service requirements of customers promptly and efficiently.

For top-level motor performance and utmost motor dependability, write, wire, or telephone our nearest representative—or communicate directly with us.

NOW ON HAND FRACTIONAL HORSEPOWER MOTORS

INTEGRAL HORSEPOWER MOTORS

3 Phase—3/4 to 125 hp.
Conforming strictly to NEMA SPECIFICATIONS FULLY GUARANTEED.

Available in the following types:

- ★ Adjustable Speed Schrage Motors
- ★ Open Drip-proof Motors
- ★ Fan-Cooled Motors
- ★ Pump Motors
- Style "C" Face Mounted
- Style "F" Vertical Solid Shaft
- Vertical Hollow Shaft

IMMEDIATE DELIVERY

from New York, Chicago,
Kansas City, New Orleans, Houston,
and Los Angeles Warehouses

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Tough Guy!

and his number is

CHAPMAN

List 960

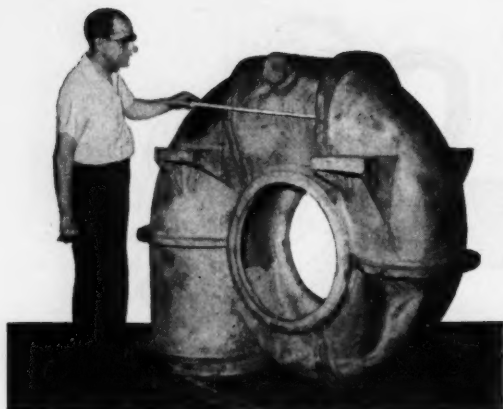


Tough — that's the word for this small Chapman Gate Valve with the forged steel body and yoke. For no matter what job you put it on, within its remarkable capacity-range, you'll find it *tougher than the toughest conditions!*

That's right, *tougher* . . . because seat rings are hardened stainless steel . . . because wedge-faces are *superhardened* by Chapman's exclusive Malcomizing Process . . . and because the stem and wedge gate connection has been given extra strength to meet any extra stress.

So no matter what your job for small forged steel gate valves, Chapman's List 960 is the one you can bet on to "lick all comers." You can get it in sizes from $\frac{1}{2}$ " to 2" . . . equipped with rising stem, either with yoke as shown, or with inside screw. Bonnet joints are gasketed or metal-to-metal. Pressure range: 2,000 lb. at 100° F., to 380 lb. at 1,000° F. For higher pressures, specify List 990. Write for Catalog No. 10.

The CHAPMAN Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS



How to get

SAND CASTINGS



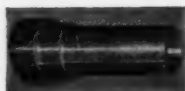
The large centrifugal pump casing (above) weighs 3370 pounds. The burner tips and atomizer fittings (at left) could be held in your hand. The variety of sizes in-between (and designs of every description) make INCO sand castings suitable for almost any process industry application. Only Nickel and Nickel Alloys are sand-cast at INCO's Bayonne Works. Castings are uniform . . . in strength, in chemical composition, in soundness, in length of satisfactory service.

PRECISION CASTINGS



The precision castings shown at the left are typical of the variety of intricate parts that are most economically cast by the investment method. In fact, if any small part requires several machining operations, chances are INCO Precision Castings can save money on large quantity production. Parts up to 5 or 6 inches in maximum dimension can be cast to tolerances as close as .005" per linear inch and frequently even finer. High nickel alloys, SAE alloy steels, stainless steels . . . all are *precision-cast* at INCO's Bayonne Works.

CENTRIFUGAL CASTINGS



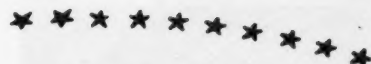
Centrifugal castings are produced in Nickel, Monel and other Nickel Alloys for use wherever cylindrical shapes are required with good mechanical strength and resistance to corrosion and abrasion. INCO's Bayonne Works produces them in rough form or machine finish from 3" to 18" in outside diameter and up to 72" in length. Imagine the saving in metal and machining costs effected by the unusual casting shown at left, custom-cast by INCO's casting specialists.

Distributors of INCO Products, U. S., Canada, Mexico

Atlanta 3—J. M. Tull Metal & Supply Co.
Baltimore 5—Whitehead Metal Products Co., Inc.
Buffalo 7—Whitehead Metal Products Co., Inc.
Cambridge 39, Mass.—Whitehead Metal Products
Chicago 23—Steel Sales Corporation
Cincinnati 29—Williams and Company, Inc.
Cleveland 14—Williams and Company, Inc.
Columbus 8, Ohio—Williams and Company, Inc.
Dallas 9—Metal Goods Corporation
Denver 2—Metal Goods Corporation
Detroit 10—Steel Sales Corporation
Edmonton, Alberta—Wilkinson Company, Ltd.
Grand Rapids 2—Steel Sales Corporation

Harrison, N. J.—Whitehead Metal Products Co., Inc.
Houston 3—Metal Goods Corporation
Indianapolis 2—Steel Sales Corporation
Kansas City 8, Mo.—Steel Sales Corporation
Los Angeles 21—Pacific Metals Company, Ltd.
Mexico, Mexico, D.F.—La Paloma Co. De Metales, S.A.
Milwaukee 9—Steel Sales Corporation
Minneapolis 13—Steel Sales Corporation
Montreal 1, Que.—Robert W. Bartram, Limited
New Haven 13—Whitehead Metal Products Co., Inc.
New Orleans 12—Metal Goods Corporation
New York 14—Whitehead Metal Products Co., Inc.
Philadelphia 40—Whitehead Metal Products Co., Inc.

Pittsburgh 33—Williams and Company, Inc.
Portland 12, Ore.—Eagle Metals Company
St. Louis 10—Steel Sales Corporation
Salt Lake City 4—Pacific Metals Company, Ltd.
San Diego 1—Pacific Metals Company, Ltd.
San Francisco 10—Pacific Metals Company, Ltd.
Seattle 4—Eagle Metals Company
Spokane 8—Eagle Metals Company
Syracuse 4—Whitehead Metal Products Co., Inc.
Toledo 2—Williams and Company, Inc.
Toronto 5, Ont.—Alloy Metal Sales, Limited
Tulsa 3—Metal Goods Corporation
Vancouver, B. C.—Wilkinson Company, Ltd.



an all-star casting

Are failures of cast parts costing you time and money? Production stoppages — machinery breakdowns — frequent repairs and parts replacement?

Then you may find an INCO Nickel or Nickel Alloy casting the ideal solution to your difficulties.

You can depend on Nickel and Nickel Alloy sand, centrifugal and precision castings wherever rough treatment and rugged operating conditions prevail. As these five examples show, they are strong. They maintain product purity. They resist erosion, corrosion and abrasion.

If one of your present castings is giving you trouble, let us help you solve the problem. Send your specifications, or a copy of your blueprint to the nearest Distributor of Inco Products.

Right now Nickel and Nickel Alloy castings are on extended delivery because of defense, so it pays to anticipate needs. And when ordering, remember to give N.P.A. rating and complete end-use information.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N. Y.



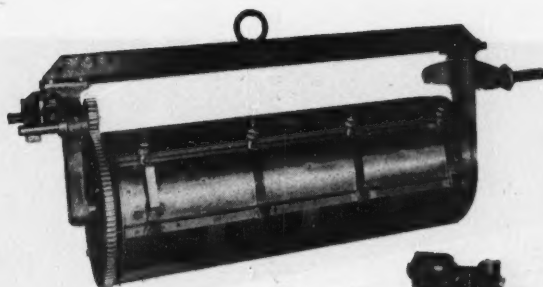
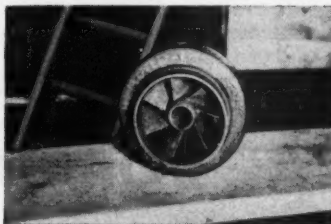
Inco Castings

Sand, Precision and Centrifugal



ABRASION RESISTANCE

This "S"® Monel sand-cast impeller gave 367% longer service than previously used metals despite the abrasive action of "coke breeze." Spinning at 1750 rpm in a gas company's quenching operation, this "S" Monel impeller served without trouble for 22 months, more than 3 times as long as some other metals. Such hardness and toughness of "S" Monel castings cut repair and replacements costs . . . save time, trouble and money.



STRENGTH

The gear-end idler, idle-end hanger, ring gear and pinion of this Monel® tumble-pickling barrel must support the heavy load . . . stand up under the tortuous grinding of the gears . . . the constant jouncing of the barrel . . . resist the corrosive action of acid and alkaline solutions. That's why they're made of cast Monel



PURITY MAINTENANCE

This cast Monel filter is guarding product purity in the manufacture of a well-known pharmaceutical product. Monel's high resistance to corrosion makes it invaluable wherever industry needs freedom from harmful metal contamination.

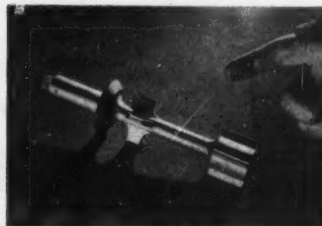


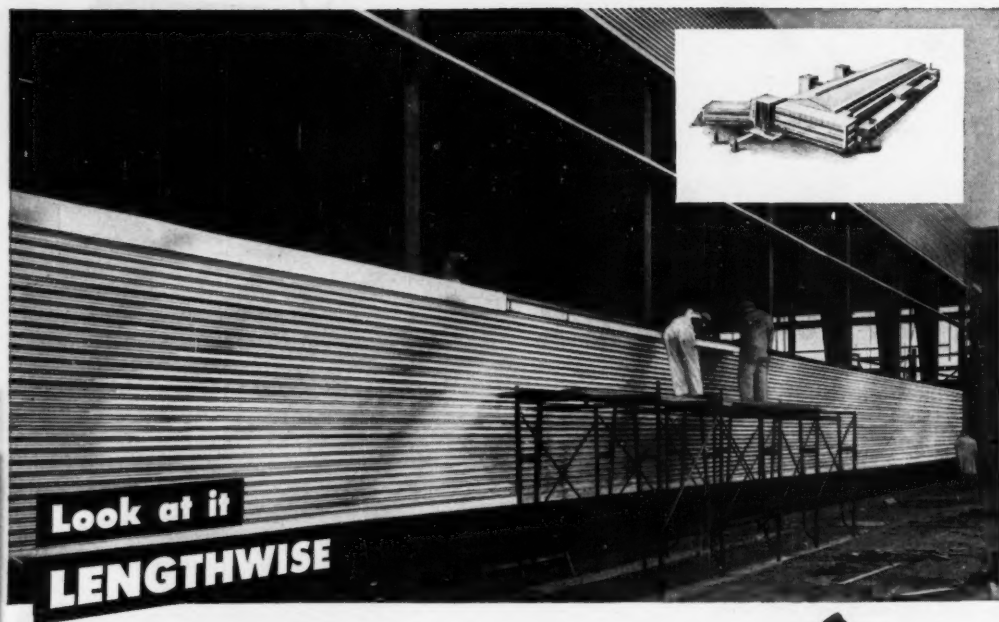
EROSION RESISTANCE

Withstanding high pressure steam blast at three times the speed of sound and 300°F., these cast Monel nozzles are still in excellent operating condition after 30 years of service. Records like this show the longer equipment life and excellent performance that can be expected from Monel castings.

CORROSION RESISTANCE

Chlorine would chew up tank car valve parts unless they were highly corrosion resistant. That's why the Chlorine Institute recommends the use of Monel for parts like this investment cast valve stem. If your problem is corrosion, it is more than likely that you can find a practical way to solve it economically with INCO castings.





**Look at it
LENGTHWISE**

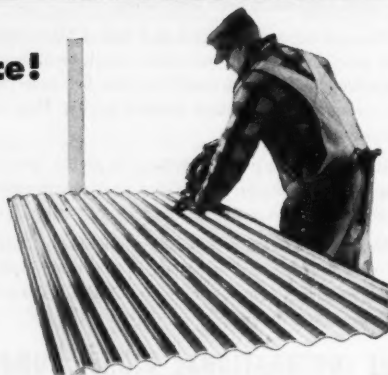
... Longer Life, Lower Maintenance!

When Hytron, Division of CBS, planned its new Danvers, Mass., plant, architects and clients agreed on Reynolds *Lifetime* Aluminum Industrial Corrugated for siding. Low initial cost, long life and lowest maintenance were practical factors. But the architects—R. P. Systems Engineers—sought a design effect, too. So they specified *horizontal* application. General contractor was L. R. Porter Construction Company.

Both as siding and as roofing (vertically applied) this material saves substantially on labor costs. It is light weight, easy to handle... workmen like it. In addition, aluminum reflects radiant heat ... keeps interiors up to 15° cooler in summer and warmer in winter.

Plan your next construction with this high-strength aluminum that never rusts, resists corrosion.

Call Reynolds for literature and technical assistance... offices in principal cities. Check your classified phone book for our listing under "Building Materials," or write to Reynolds Metals Company, Building Products Division, 2042 South Ninth Street, Louisville 1, Kentucky.



Specifications:

Thickness .032"
Weight 56 lbs. per square
Corrugations $\frac{7}{8}$ " deep, 2-2/3" crown to crown
Roofing width 35", coverage 32"
Siding width 33-3/4", coverage 32"
Lengths 5', 6', 7', 9', 10', 11', 12'

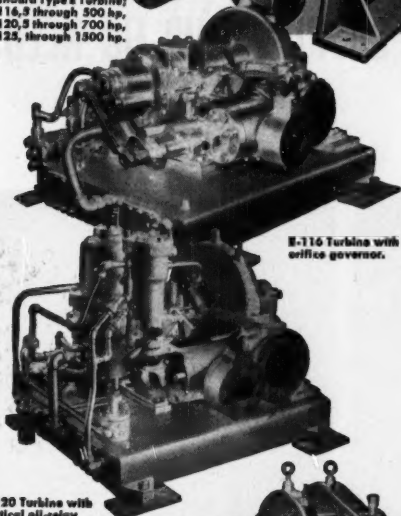
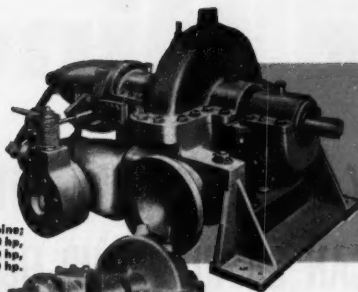


Military demands for aluminum limit supply, but Reynolds is rapidly expanding aluminum capacity. Rated orders receive priority handling.

REYNOLDS *Lifetime* ALUMINUM INDUSTRIAL CORRUGATED

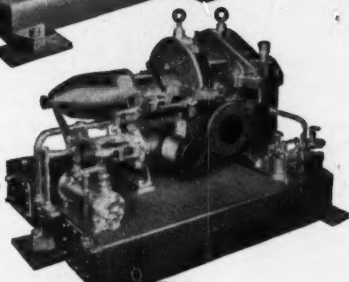
Take the *Guesswork* out of Turbine Selection!

Standard Type E Turbines;
E-116, 3 through 500 hp,
E-120, 5 through 700 hp,
E-125, through 1500 hp.

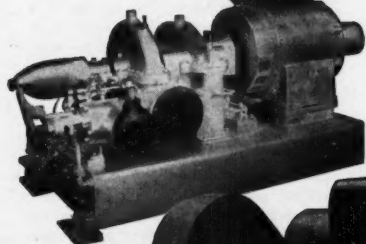


E-116 Turbine with
oil-relay governor.

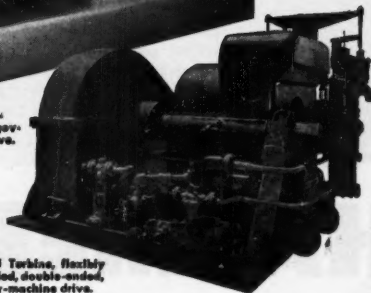
E-120 Turbine with
vertical oil-relay
governor.



E-116 Turbine, close-
coupled gear; shaft
governor.



E-120 Turbine, close-
coupled gear; shaft gov-
ernor—generator drive.



M-25 Turbine, flexible
coupled, double-ended,
paper-machine drive.

Westinghouse General-Purpose Turbines can be supplied for mechanical or generator drive... either direct connected or geared... for condensing or noncondensing operation. This *complete* line... plus a nationwide staff of trained steam engineers, conveniently located sales offices, and service shops... assures you of the correct solution to *your* steam-drive application problem.

The single-stage Type E turbine, with designs for three basic classes of steam conditions, three wheel sizes and three standard governor types, provides in effect twenty-seven *standard, economical* variations to cover a wide range of applications. In addition, an almost limitless number of special applications can be met through the use of heavy-duty parts, and optional accessories.

Geared-turbine drives are offered either flexibly coupled to accommodate either right- or left-hand gear offsets, double-ended output shafts; or close-coupled (Gearturbines). Gearturbines are standardized on a single offset arrangement, affording utmost economy.

Other types in the complete Westinghouse general-purpose turbine line include heavy-duty and multi-stage units for applications requiring high temperatures and pressures, higher speeds, greater horsepower, extraction for process applications, or higher efficiency than may be had with single-stage machines.

The superiority of the Westinghouse line is the result of over 60-years' design, manufacture, and application experience. To get the benefit of this broad know-how, call your nearby Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-50352

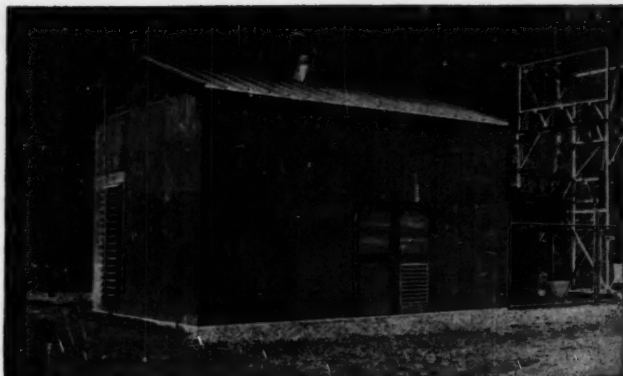
YOU CAN BE SURE... IF IT'S
Westinghouse

**GENERAL-PURPOSE
TURBINES**

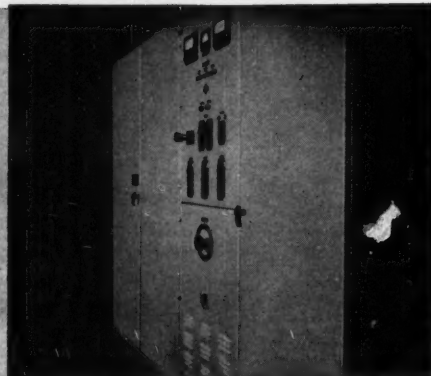


Whether Mine..

**ALLIS-CHALMERS MERCURY ARC RECTIFIERS WITH
EXCLUSIVE DESIGN FEATURES CAN SUPPLY YOUR DC NEEDS**



OUTSIDE view of one of five Allis-Chalmers rectifier substations serving the haulage system of a coal mining operation. Transmission line enters building at right, dc leaves at left. Entire substation can be moved as coal seams are exhausted, leaving only concrete slab behind.



INSIDE is the "dead front," factory packaged, 500 kw, 275 volt dc, sealed tube rectifier. Compartments are (L to R): for rectifier tubes, firing and auxiliary control, dc cathode breaker.



◀ **PUMP** evacuated rectifiers are applied in heavy duty service from 750 kw up. The 3400 kw, 500 volt unit seen here operates in parallel with steam turbine driven dc generators in the electrolytic reduction of metal.

SIDE view of pump evacuated rectifier at left, showing the centralized placement of auxiliaries — exclusively Allis-Chalmers. Both evacuation equipment and heat exchanger are accessibly placed at one end. ▶

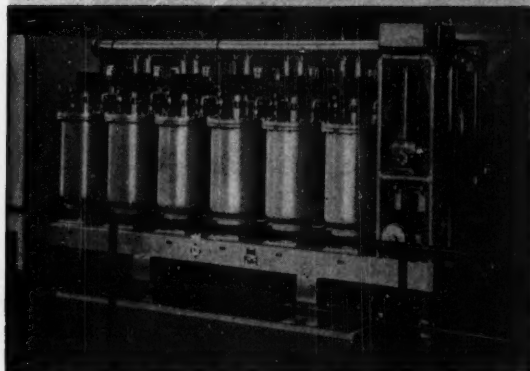
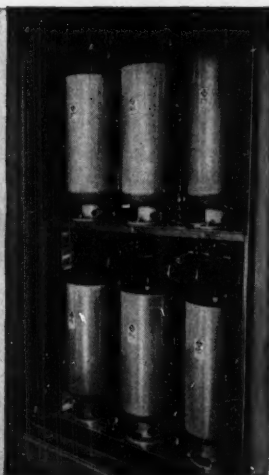
ALLIS-CHALMERS

Allis-Chalmers Engineers Introduced Mercury Arc Rectifiers to U.S. Industry

. or Mill!

MERCURY ARC RECTIFIERS

MODERN Allis-Chalmers design sealed tubes are located in the tube compartment. Other sealed tube units are supplied in ratings from 200 to 1000 kw.



WHEREVER DC IS NEEDED, from the mine to the mill, from the Elevated to the elevator, Allis-Chalmers rectifiers are quietly working away.

They combine the high efficiency, low maintenance characteristics of the mercury arc rectifier with exclusive A-C refinements in design and construction.

Factory packaged, light in weight, and requiring no special foundation, they can be placed right at the load center to cut dc feeder losses. Conversion efficiency is higher at all loads with large power savings during light load periods.

And in addition, only from Allis-Chalmers can you get rectifiers with these exclusive design refinements:

EXCLUSIVE ALLIS-CHALMERS FEATURES

- **Fixed excitation anode**—doesn't contact mercury and is independent of level, turbulence or impurities... requiring no adjustment, maintenance or replacement.
- **Continuous excitation**—pilot arc always present, eliminating need for continuous and synchronized re-ignition. Rectifier will ride through severe ac voltage disturbances.
- **Grid phase control**—in cooler and cleaner region near anode, where ion density is lowest.
- **Internal cooling system**—high heat transfer with seamless tube cooling coil located within the rectifier.
- **Arc-over-free tank**—eliminates danger of arcing over to tank by insulating entire arc path.
- **Enamelled anode seals**—multi-layer fused vitreous construction provides high-strength seal, unaffected by thermal variation.

All these design advances are obtainable *only* from Allis-Chalmers. When you consider mercury arc rectifiers in your expansion or modernization planning, consider Allis-Chalmers.

For help with rectifier application and a fuller explanation of exclusive superior features, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3681

10 Mercury Arc Rectifier Advantages:-

- ★ Compact and light weight
- ★ No special foundation
- ★ Push button starting with no synchronizing
- ★ Quiet operation with high power factor
- ★ Low idling loss and high conversion efficiency
- ★ High momentary overload capacity
- ★ Immunity to frequent power circuits
- ★ No moving parts, contributing to low maintenance cost
- ★ No attendance needed during operation
- ★ Resistant to moisture, fumes
- ★ Simple construction with long life



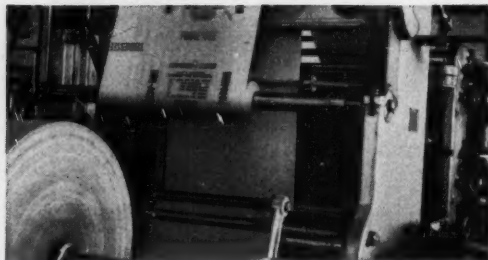
HUDSON MAKES ITS OWN KRAFT in a modern, electronically controlled mill that sets new standards in kraft manufacturing. The strength and quality

of your Hudson Multiwall Sacks are uniform, because Hudson controls every step in the manufacturing process from tree to the finished sack.

Here is why you can rely on Hudson for multiwall sacks



FROM TREE TO SACK. Hudson grows 427,000 acres of its own timber, assuring a dependable source of kraft-making pulp. From tree to sack—there are no missing links in your chain of multiwall supply.



MEETS EXACTING SPECIFICATIONS. The long, interlocked fibers of Hudson kraft build an extra margin of strength into your Hudson Multiwall Sacks—to meet your most severe specifications.



30 YEARS' KRAFT EXPERIENCE. Hudson is old enough and big enough to be reliable. Hudson Multiwall Sacks are made to your exact specifications, and are shipped on the day promised.



HUDSON MULTIWALL SACKS

Pasted and sewn—valve and open mouth

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Just drop us a note.



HUDSON PULP & PAPER CORPORATION Dept. 134 505 Park Ave., New York 22

Will the years say **"STOP"** to your **PROCESS LINES?**

Why take a chance with process lines that clog with rust? Chase® Copper Water Tube has *proved* its corrosion-resistant, non-rusting qualities.

Even heavy industrial fluids like paper pulp flow freely through Chase Copper Water Tube. Its smooth interior surface offers little resistance.

Chase Wrought Solder-Joint Fittings are pressure-tight and leak-proof. That's why they're ideal for process gases and refrigeration.

It will pay you to inquire about lightweight, easy-to-install Chase Copper Water Tube for your next process line installation.



Even after Chase Copper Water Tube carried pulp fluids in a paper mill year after year the cross-section still looks like this.



Why gamble with pipe that can rust up inside... impede flow... increase pumping costs. Use Chase Copper Water Tube.

Chase **BRASS & COPPER**

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

• The Nation's Headquarters for Brass & Copper

Albany†	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver†	Minneapolis	Pittsburgh	Waterbury
Boston	Detroit	St. Louis	Providence	
Chicago	Indianapolis	New Orleans	Washington	(Telex office only)
Cincinnati				



what a picture
of savings
this film develops



Vis

VISQUEEN keeps product 100% pure!

VISQUEEN is pure, tasteless, odorless, unaffected by acids or alkalis. Won't stick to itself or products. Has high tensile strength and tear resistance. Remains strong and flexible even at temperatures as low as 72 degrees below zero. Won't split, shatter or crack.

Photographic and X-ray chemicals are "hot" liquids. So corrosive that only bulky, heavy, costly to ship glass containers could be used . . . until VISQUEEN came along! Now, with tough, chemically inert VISQUEEN film liners, corrosive chemicals can be shipped in tin safely, and at big savings. Like this:

33½% LESS WEIGHT FOR EACH UNIT!
25% SAVED IN PACKAGE SIZE!
UP TO 35% SAVED IN SHIPPING COSTS!



Better packaging like these corrosive liquid liners of VISQUEEN film . . . is the result of the closely-knit teamwork between VISQUEEN and VISQUEEN converters . . . the nation's leading producers of flexible packaging. Converters who give you the advantage of acknowledged polyethylene leadership—the sum total of VISQUEEN's vast technical resources and backlog of applied experience. The only polyethylene converters able to put technicians direct from the factory (engineers and chemists) in your plant to work with you on your particular packaging problem.

It means this: you get the better packaging, the new packaging, which means bigger economies. Use coupon below for names of converters in your area . . . and details on the latest liquid, semi-liquid and solid packaging with VISQUEEN. Do it better—do it with VISQUEEN.



Queen film... a product of

THE VISKING CORPORATION

World's Largest Producer of Polyethylene Sheeting and Tubing
Preston Division • Terre Haute, Indiana
In Canada: Visking Limited, Lindsay, Ontario

IMPORTANT! VISQUEEN film is all polyethylene, but not all polyethylene is VISQUEEN. VISQUEEN is the only film produced by process of U.S. Patent No. 2461975. Only VISQUEEN has the benefit of research and technical experience of The Visking Corporation, pioneers in the development of polyethylene film.

©T. M. The Visking Corporation

THE VISKING CORPORATION, BOX 18-1410
Preston Division
Terre Haute, Indiana

Please send names of VISQUEEN converters in my area.

Name

Company..... Title

Address

City..... Zone..... State

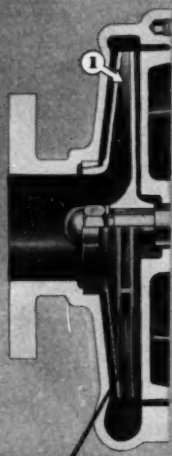
DE LAVAL

CP PROCESS PUMPS

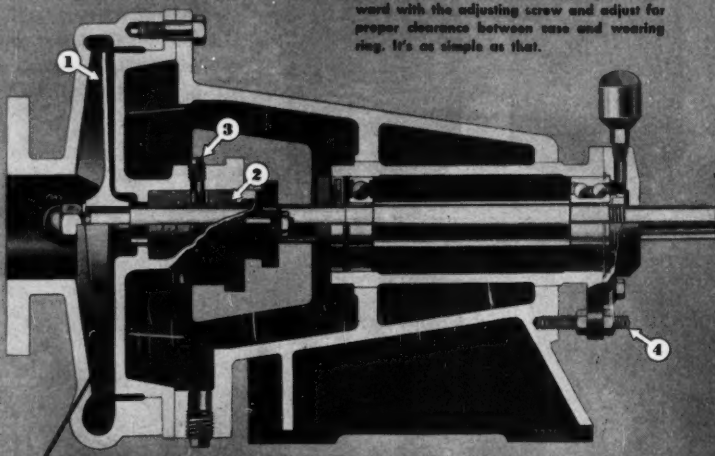
Two process pumps in one!

Look at these
design extras

SIZES TO 6"
CAPACITIES TO 1800 GPM
HEADS TO 200'



CLOSED IMPELLER



OPEN IMPELLER

- ① Choice of open or closed impellers.
- ② Choice of flexible packing or mechanical seals.
- ③ Inlet-outlet water seal connections provide cooling liquid and cooling for mechanical seals.
- ④ Entire rotor can be adjusted axially by external adjusting screw.

When wear occurs on impeller face or case of open impeller pumps, simply face off worn parts, re-assemble and adjust to proper clearance with the adjusting screw. No shims needed—no fancy fits.

On closed impeller pumps the tapered wearing ring does the job. When wear occurs all you do is move the rotor and impeller forward with the adjusting screw and adjust for proper clearance between case and wearing ring. It's as simple as that.

Let this two-in-one construction trim your pumping costs. If service requirements change, De Laval CP pumps can be quickly converted from closed to open impeller (or vice versa) by simply changing the pump volute and impeller. *There's no need to buy a whole new pump.*

CP pumps can be quickly changed from flexible packing to mechanical seals too. Gland faces are

pre-machined and drilled to make it an easy job.

Whatever your processing application . . . whether you want to pump hot or cold clear liquids, viscous liquids, corrosive liquids or those carrying suspended solids . . . these versatile two-in-one CP pumps can meet changing requirements in your plant. Bulletin 1125 tells fully why they are . . . **DESIGNED TO STAY ON THE LINE.**



DE LAVAL

Process Pumps



DE LAVAL STEAM TURBINE COMPANY
Trenton 2, New Jersey

People will talk

開密克幫我們發展工業。
"Chemico helped us develop our industry"

"Chemico" heeft ons meer
gegeven dan wij verwachtten.
"Chemico gave us more than we expected"

رَبِّهِ «كِيمِكُو»
"It's designed by Chemico"

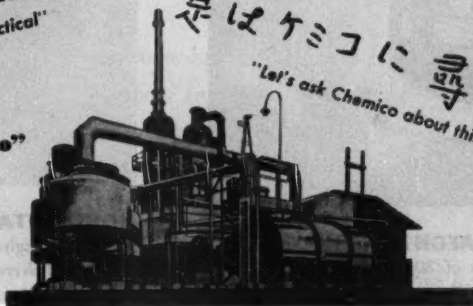
“केमिको” ने सारा काम किया।
"Chemico did the whole job"

"CHEMICO" SABE SE É PRÁTICO.
"Chemico knows whether it's practical"

La reputación de "Chemico"
nos ha persuadido.
"Chemico's reputation sold us"

"Chemico" comprend nos problèmes.
"Chemico understands our problems"

是はケミコに尋ねよう!
"Let's ask Chemico about this"



When our representatives travel to the far corners of the earth, they find that word of Chemico's activities has gone before them.

Yes, people *will* talk . . . and carry the news of Chemico accomplishments in the design and construction of plants for the production of heavy chemicals: fertilizers for India, Mexico, the Philippine Islands and Egypt; sulfuric acid for Canada, England, Formosa and Brazil; urea for Japan; sulfur recovery for Colombia; pickle liquor recovery for

the Union of South Africa, to name a few. And naturally these are in addition to numerous large-scale projects in the United States.

Chemico has created, designed and erected more than 800 installations during the past 37 years that have given people much to talk about. That's why "Discuss it with Chemico" has become a byword of those who need new facilities or additional plant capacity to meet the world's ever-expanding heavy chemical needs.

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

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TECHNICAL REPRESENTATIVES: CYANAMID PRODUCTS LTD., LONDON • CHEMICAL CONSTRUCTION (INTER-AMERICAN) LTD., TORONTO • SOUTH AFRICA CYANAMID (PTY) LTD., JOHANNESBURG

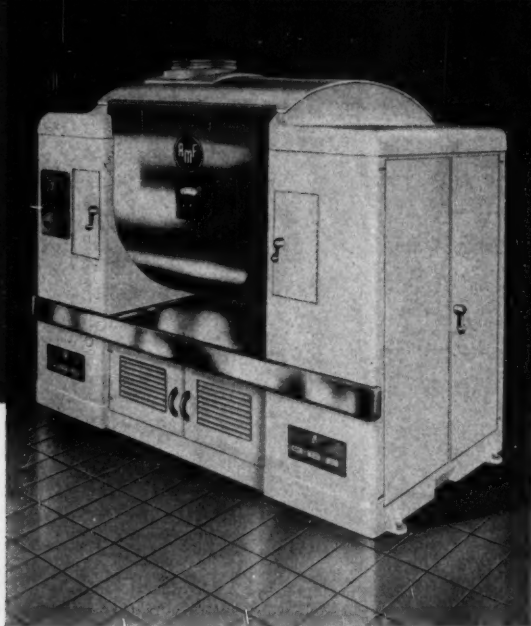


Chemico plants
are profitable
investments

IS THE BETTER MIXER



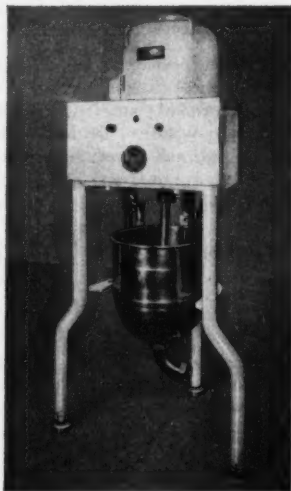
VERTICAL BATCH? This AMF Glen Mixer® — with capacities of 30, 40 or 85 gallons — has proved to be the right answer for a myriad of mixing problems. Its exclusive Variable Ratio Drive and Variable Speed Control make it a flexible machine and extend its adaptability to a wide variety of materials. Its ease of cleaning, ease of loading and unloading means faster, uninterrupted production. Steam-jacketed bowls, completely covered bowls for dust control, interchangeable beaters and other accessories are available.

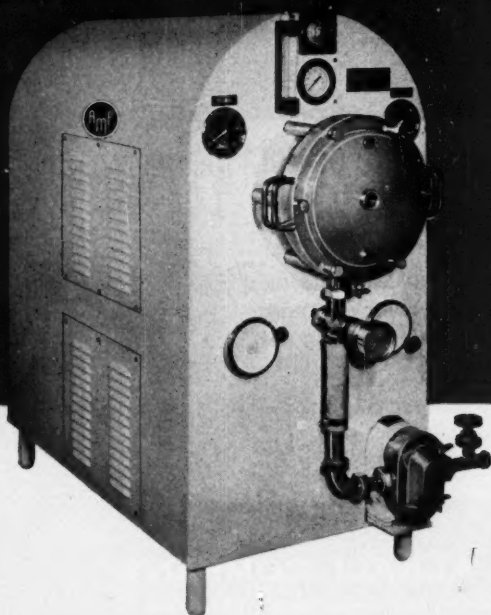


HORIZONTAL BATCH? For heavy-duty mixing needs, this AMF High-Speed Horizontal Mixer is unique. Equalized double-end drive capable of handling heavy-duty work; automatic unloading; push-button control and other features make this AMF mixer a standard in many industries.

NEW! AMF DISC BLENDER

For continuous combining of dry and wet ingredients in a small bowl with large through-put capacity, the choice is the new AMF Disc Blender. Because of the unique design and shear action of the twin discs, a smooth-finished mix is obtained without agglomerates. The AMF Disc Blender is also excellent for fast conversion of certain slurries into homogeneous emulsions, with production as high as 8,000 pounds per hour on certain materials.





CONTINUOUS? Users of the AMF Oakes Continuous, Automatic Mixers find they get thorough, more stable, more uniform mixes; also greater yield. The automatic operation cuts labor costs. Easy cleaning features permit switching from one mix to another—in minutes. An Oakes occupies little floor space, requires simple maintenance. Its transmission of horsepower to product being mixed is highly efficient. Capacity: up to 6,000 lbs. per hour.

AMF MIXERS USED IN MANUFACTURE OF
EVERYTHING from light foam batches to heavy,
abrasive pastes • plastics • abrasives • cosmetics
foam rubber • pharmaceuticals • color dispersions
insecticides • food and confectionery products

In some cases, continuous mixing is the better method. In others, it might be batch-mixing—either horizontal or vertical.

Since we manufacture both types of mixers, our recommendations are made with *your* interest in mind. With over 20 years' experience in the development of mixing equipment for a variety of products in many fields, chances are we've handled problems similar to yours. If you desire, we'll take your problem into our research laboratory, make test runs, work with you all the way.

You're invited to see these machines, as well as auxiliary materials handling equipment, on display, and discuss your mixing problems with our engineers at Booth #60, 7th National Chemical Exposition, the Chicago Coliseum, September 9-13.



AMERICAN MACHINE & FOUNDRY COMPANY—511 Fifth Avenue, New York 17, N. Y.
West Coast Sales & Service Headquarters: 1258 Mission St., San Francisco 3, California
Southwest Sales & Service Headquarters: 2106 Irving Boulevard, Dallas 2, Texas

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Bringing new light to bear on the varied uses of

its products is part of Niagara's service to industry.

NIALK® Carbonate of Potash

This potash salt is finding increasing favor in the development and production of special dyes for the textile industry, since its carefully controlled purity and quality are particularly helpful in achieving and maintaining a true color.

Quality plus cooperation keeps NIALK products at the forefront in research and product improvement.

NIAGARA ALKALI COMPANY

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* NIALK LIQUID CHLORINE NIALK CAUSTIC POTASH
NIALK CARBONATE OF POTASH NIALK PARADICHLOROBENZENE
NIALK CAUSTIC SODA NIALK TRICHLOROethylene
NIAGATHAL® (TETRACHLORO PHTHALIC ANHYDRIDE)

NOW...with the proved Cooper-Bessemer JS



THE above illustration diagrams the advantage you now stand to gain with the supercharged, aftercooled* Cooper-Bessemer JS-8.

Many a man who knows heavy-duty engines has wished for JS performance beyond the previous top rating of 1,000 bhp. And here it is . . . 1,450 bhp . . . with every cost-saving, trouble-avoiding feature for which the JS is noted, plus even *higher* efficiency thanks to aftercooling.

With almost 50% *more power* the record-setting JS can now do a bigger, better job than ever before — and with no appreciable increase in weight or space!

Check with the nearest Cooper-Bessemer office for the latest details.

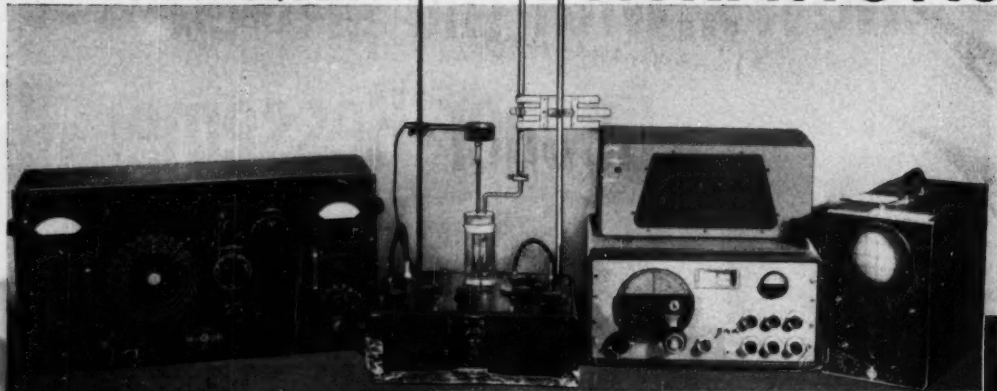
*Aftercooling water-cools combustion air between supercharger and intake manifold, thereby permitting more air for greater power and higher efficiency.

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Corporation

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MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New, SENSITIVE, STABLE, AND FLEXIBLE EQUIPMENT for HIGH-FREQUENCY TITRATIONS



Photograph Courtesy Department of Chemistry, West Virginia University, Morgantown, West Va.

This set-up includes the G-R Type 821-A Twin-T Bridge, the cell, the G-R Type 805-C Standard Signal Generator as the high frequency oscillator, and the Hallicrafters SX-42 receiver as detector. The loudspeaker and oscillograph may be used for audio and visual observation of the null point.

The cell consists of a glass tube on which are mounted two copper rings (22 mm wide) which serve as electrodes. An insulating strip between these bands keeps them 25 mm apart. Copper wires soldered to the rings are connected to a banana plug which plugs into the unknown terminals of the bridge.

The General Radio Type 821-A impedance measuring circuit is an accurate, direct-reading instrument for the determination of conductance and susceptance over a wide range of frequencies. By simply determining the cell conductance and susceptance with the initial solution in position and the corresponding values after addition of successive increments of the second solution, the end point may be precisely noted. The discreet discontinuity in the plot of the difference of initial and final conductance and susceptance readings versus the quantity of the second solution added, accurately determines the chemical end point.

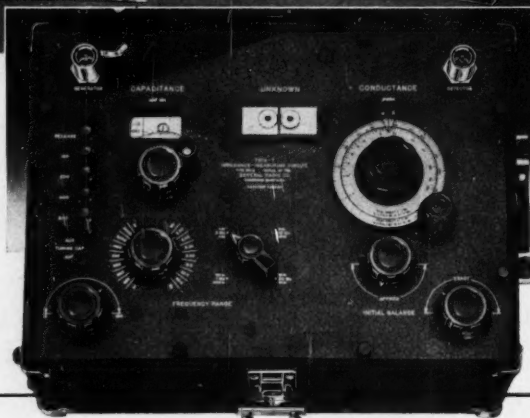
High frequency chemical analysis now promises to be widely used, but few chemists have the time, skills, or facilities to construct their own apparatus. Except for the easily constructed glass titration cell, all the equipment necessary is standard and commercially available.

Measurements are rapid. They can be made over a frequency range of 460 kilocycles to 40 megacycles. The apparatus is extremely easy to operate. The bridge has excellent stability and sensitivity.

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method agree with indicator-determined end points to within the precision of the buret readings. Availability of the apparatus and simplicity of operation now enables analysts confidently to apply high frequency bridge titration to their problems.

Write for the reprint "High-Frequency Titration" for complete information.



Type 821-A Twin-T Impedance Measuring Circuit—\$520

Frequency Range: 460 kc to 40 Mc

Capacitance Range: 0 to 1000 μ sf

Conductance Range: 0 to 100 μ mho at 1 Mc 0 to 1000 μ mho at 10 Mc
0 to 300 μ mho at 3 Mc 0 to 3000 μ mho at 30 Mc

Accuracy

Capacitance $\pm (0.1\% + 2 \mu$ sf)

Conductance $\pm (2\%$ of actual
dial reading plus 0.1% full scale)

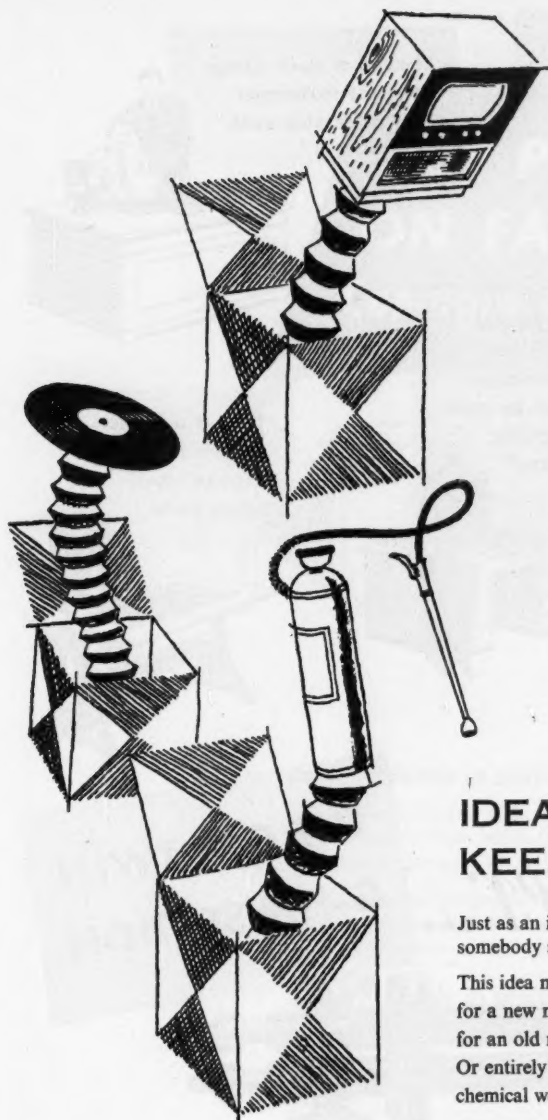
Accessories Supplied

Two coaxial cables for connections to generator and detector



GENERAL RADIO Company

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This advertisement is one of a series currently appearing in *Wall Street Journal*, *New York Journal of Commerce* and *Fortune*. The series aims to point out to the investing public and to management that, as the economy grows, so grows the chemical industry. And that as the industry grows, so do its potentialities for profitable investment.

IDEAS KEEP POPPING UP

Just as an industry seems developed to its optimum, somebody sparks a new idea.

This idea may suggest established materials like glass and metal for a new market—television. Or a new material for an old market—plastic recordings.

Or entirely new materials for a brand-new market—chemical weed and insect killers.

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"I need a stock design of heat exchanger for quick shipment."



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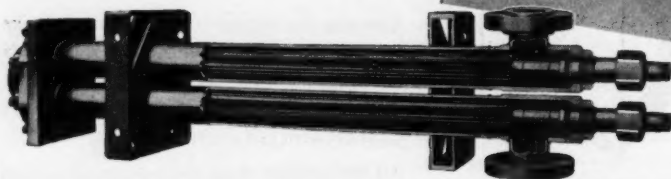
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Yes, this "Universal Heat Exchanger" meets all these needs . . . and many more. It actually has the widest range of heating, cooling, condensing and heat exchange applications of any heat transfer apparatus on the market. • The G-R Twin G-Fin Section has proved its effective design and

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• This unit is the simplest type of heat exchanger, easy to install, economical to maintain, and with high salvage value because of its standardized design. Write for bulletin describing the many Twin G-Fin Section advantages in detail.

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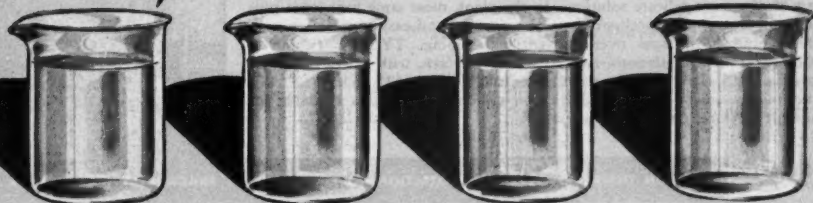
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Sorbitol, tested independently, showed no significant variation among twenty samples. But the same tests found wide variations in batch after batch of other polyols!

FACT: Sorbitol leads in price stability and availability

Atlas sorbitol, made from sugar, is available in almost unlimited quantities. What's more, on price stability alone, sorbitol rates the "best buy" in polyols: its price trend through the years has been downward.

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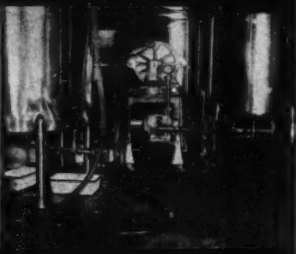
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expensive corrosion problems

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As tubing

TYGON PROVIDES SAFE TRANSMISSION FOR VIRTUALLY ANY LIQUID, GAS OR SEMI-SOLID

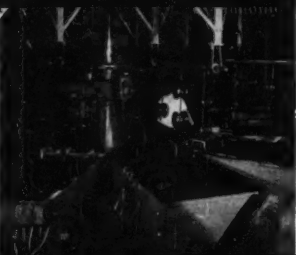
TYGON Tubing is widely used in both plant and laboratory. In the "lab," TYGON's glass-like clarity, full flexibility, smooth surfaces, non-contaminating and non-oxidizing properties make it quicker, easier, safer and cheaper to use in the most intricate "set-ups" or with the most delicate solutions. In the plant, these same properties plus its light weight, high strength, excellent abrasion resistance and easy installation, give TYGON tremendous advantages over conventional piping. TYGON Tubing is available in six standard formulations, in clear or glossy black, with a wide range of physical, chemical and electrical properties. Sizes range from .12" I.D. to 2" I.D. Braided jacket reinforcement in fabric, plastic and stainless steel is also available for use with constant working pressures up to 300 psi.



As linings

TYGON OFFERS HEAVY DUTY PROTECTION TO EQUIPMENT OF PRACTICALLY ANY SIZE OR SHAPE

TYGON press-polished sheeting in thicknesses of 3/32" or 3/16" makes it ideally suited to the protection of tanks, tank cars, diffusional towers, vats, reactors, bins, hoppers, troughs, pipe and other processing equipment against a wide range of chemicals. Its unique resistance against oxidizing acids, oils, greases and certain solvents permits the use of TYGON in jobs other linings cannot handle. Its wear resistance assures long life with the most abrasive materials. Its flexibility permits close conformance to the most intricately shaped equipment. Its lack of the need for "curing" makes possible installations of virtually any size. TYGON, for lining work, is available in two standard compounds—TL 104 (Black) for general use and TL 104-A (White) where solution visibility is desired.



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TYGON PROVIDES POSITIVE, ENDURING SEALS FOR ALL TYPES OF PROCESSING EQUIPMENT

Die-cut, molded, or extruded, TYGON is the sure answer to tough gasketing jobs in chemical processing or general industrial equipment. Its chemical resistance, abrasion resistance, resilience, high strength, non-contaminating and non-oxidizing properties make it practical to use under a wide range of operating conditions. TYGON gaskets can be die-cut from calendered or press-polished sheeting (1/64" to 1/2" thick); can be molded in practically any size or shape; can be extruded as tubing, solid cord, strip, or channel in continuous lengths. A number of standard compounds are available.



As paint

TYGON OFFERS EASILY APPLIED, LASTING PROTECTION AGAINST CORROSIVE FUMES AND SPILLAGE

As a paint, TYGON is primarily used to protect plant and equipment against corrosive fumes and spillage. It is also used against immersion in mild corrosives or to prevent contamination of delicate solution. TYGON Paint is easily applied and quick drying. Dry, its film is chemically resistant, tough, flexible, and smooth; resistant to cracking, chipping or crazing. There are two types of TYGON Paint available. TYGON "Series K" Paints do not require a primer and are used against mild corrosion. TYGON "Series TP" Paints are for use with primers under severe conditions of corrosion. TYGORUST, the "no-prep" vinyl primer is recommended for use under either type of TYGON PAINT on rusted metal—wet or dry.



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THE Chementator

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Prepared under the editorial direction of Joseph A. O'Connor, News Editor

How close is electrolytic titanium?

That long sought electrolytic titanium process may not be far off. Many companies are sure they've just about got one.

Du Pont is hard at work on a cell in which it will try out its process. Titanium tetrachloride will be fed continuously into the cell, where it will be dissolved in fused alkali halides—most likely a eutectic mixture of lithium and potassium chlorides. The cell will operate at about 400 deg. C. and the melt will be blanketed with argon under slight pressure to keep out oxygen and nitrogen. Titanium will deposit at the cathode, and free chlorine will be evolved at the carbon anode.

In a commercial operation, the chlorine could be used to produce more titanium tetrachloride. Magnesium reduction is eliminated. Instead, electric energy now consumed in regenerating magnesium will be used directly to produce titanium.

Dow Chemical, which just got a whopping \$100 million from a record sale of debentures to keep its over-all expansion going, also has a titanium process of its own, using the electric cell method. It's now being pilot-planted, and Dow will get into the titanium business when it thinks the time is right.

Banking on the process it is developing in cooperation with National Research Corp., Monsanto likewise expects to become a producer of titanium. Equally sure that they have an efficient process, Ferro Corp. and Horizons, Inc., are also in the race. Union Carbide has quietly acquired rights to the Horizons titanium process.

Allied clears for action

Apparently Allied Chemical & Dye Corp. is beginning to unload some of its big portfolio of blue chip securities. Allied's holdings include large blocks of U. S. Steel, Owens-Illinois Glass, American Viscose and Air Reduction, carried at cost of \$30 million, but currently worth about \$70 million on the market. How much of its holdings Allied has liquidated or will dispose of isn't known. It's agreed, however, that about half of its 342,000 shares of U. S. Steel have gone by the board.

This act signals more aggressive expansion. Allied plans to spend about \$75 million this year on new plants, probably the most it has ever spent in one year for expansion. As much again may be shelled out in 1953.

Allied is dipping into its own kitty to finance this year's program, will probably shun outside financing again next year. Allied has no outstanding obligations that come ahead of its common shares.

Nylon paces fiber expansion

Du Pont and Allied got the last four certificates for fast tax writeoffs on nylon plants as DPA closed the books on its synthetic textile expansion program.

Three certificates went to Du Pont for nylon plants at Chattanooga, Tenn., Seaford, Del., and Martinsville, Va., with a combined capacity of close to 82 million pounds a year. DPA authorized Du Pont to write off 40 percent of the more than \$42 million it will cost to build the plants. Allied Chemical & Dye got the fourth certificate, authorizing it to write off 40 percent of more than \$23 million, for a nylon plant to turn out 20 million pounds annually. Allied hasn't picked a site yet.

The final four certificates cover facilities with a total proposed capacity of almost 102 million pounds of nylon annually. They will bring the nation's nylon capacity to a total of 270 million pounds a year by 1956, when DPA expects them to be completed.

DPA turned down 27 bids totaling about \$443 million for plants to make synthetic fibers other than nylon. Two were from Union Carbide for facilities to produce dynel, two from Du Pont to make Orlon and Dacron, one from Saran Yarns Co. to produce Saran, one from American Cyanamid to make acrylic staple, and one from Tennessee Eastman to produce acrylic fiber. Most of these plants are already under construction despite DPA's refusal to grant fast tax write-offs.

The other turned-down bids included 10 for fast amortization on plants valued at \$112 million for production of high-tenacity rayon and another 10 applications to build \$154 million worth of plants to produce acetate and viscose rayon products other than high-tenacity rayon.

In setting a synthetic textile expansion goal of 300 million pounds of capacity to produce non-cellulose fibers, consisting of 270 million pounds of nylon capacity and 30 million pounds of Acrilan capacity, DPA won out over NPA, which had sought to include more of the other fibers in addition to nylon. DPA

(Continued on page 104)

THE CHEMENTATOR, continued

opposed this, pointing out that nylon was the only fiber for which future military needs were higher than the nation's anticipated production capacity. Even so, Chemstrand's bid for a fast writeoff for its Acrilan plant managed to squeak through in what was intended to be an all-nylon program before the government decided just what fibers it would need.

New processes mean more uranium

The U. S. is not as worried about the threat of a uranium scarcity as it once was. There's plenty in the Belgian Congo, Canada, elsewhere in the free world and even in the United States.

What's more, there are newer and cheaper ways of getting uranium. Producers of phosphate fertilizers who get their phosphoric acid by the wet process will recover uranium from phosphate rock. The new acid leaching process of Chemical Construction Corp. has already been tried on ore concentrates from the Beaverlodge uranium operation of Canada's Eldorado Mining Co. in Saskatchewan, and the process could be used on other uranium concentrates. In South Africa, uranium is being recovered as a byproduct of gold mining, using an ion exchange process developed by Permutit.

All this makes possible peak output of atomic bombs. It also brings closer the day when atomic energy can be harnessed for industrial power production.

Japan seeks share in Alaskan pulp

Japan hopes to participate with the United States in a joint project to produce pulpwood in Alaska.

Main points in the Japanese plan are: (1) an American-Japanese pulp mill in Alaska to turn out 100,000 tons of pulp a year; (2) big shipments of pulpwood logs to Japan for further processing; and (3) a capital outlay of \$20 million.

Japan believes the International Bank for Reconstruction and Development would lend money for the enterprise. Japanese capital would come from the government and from private pulp and rayon manufacturers. Experts from Japan expect to size up possibilities in Alaska soon.

Mathieson: Nichols picks up another

If Mathieson Chemical Corp. acquires E. R. Squibb & Sons by a stock swap (five shares of Squibb common for three of Mathieson) as expected, hustling President Thomas S. Nichols of Mathieson will have put through his biggest deal yet. The merger will produce a giant with over \$250 million in net assets, making Mathieson the sixth biggest chemical company in the U. S.

This is but one more step in the aggressive expansion initiated by Nichols. Since he took over in 1948,

Nichols has quadrupled Mathieson's assets to more than \$142 million by shrewd acquisitions of thriving companies.

When he took over, Mathieson had only three plants and was a producer of soda ash, caustic soda and chlorine. By mergers and purchases, Nichols increased the Mathieson spread to 20 plants in 10 states, moving first into fertilizers and then into petrochemicals.

In 1949 Mathieson absorbed two major producers of fertilizers and acquired two of the biggest sulphuric acid plants in the world. Since then, it has picked up two smaller agricultural chemical firms.

Mathieson likewise produces ammonia for fertilizers. Its Morgantown, W. Va., plant is one of the largest in the U. S., making 200,000 tons a year. Other important Mathieson plants are at Niagara Falls, Lake Charles, La., Saltville, Va., and Baltimore, its headquarters.

In 1950 Mathieson moved into petrochemicals when it teamed with Tennessee Gas Transmission to organize Mathieson Hydrocarbon Chemical Corp. Object: to strip hydrocarbons from natural gas and convert them into ethylene glycol and other petrochemicals in a plant near Brandenburg, Ky. Last year, Mathieson acquired Mathieson Hydrocarbon by an exchange of stock.

Recently Mathieson purchased 137,225 shares of American Potash & Chemical Corp. from Heyden Chemical Corp. Nichols wanted to combine American Potash with Mathieson. When this fell through, Mathieson sold 120,000 of the shares to American Potash at \$40 a share and the remaining 17,225 to Lehman Brothers for the same price.

Today Mathieson manufactures raw materials for synthetic fibers, makes ethylene glycol for antifreeze, is an important producer of carbon dioxide in solid form and a top U. S. fertilizer manufacturer. Rocket fuels provide one market for another important Mathieson product—hydrazine.

Picking up the 94-year-old Squibb business will put Mathieson into pharmaceuticals. Squibb, with main plants in Brooklyn and New Brunswick, N. J., is one of the nation's largest producers of antibiotics, vitamins, sulfonamides and other drugs. It produces penicillin and streptomycin, and its researchers developed the even more effective dihydrostreptomycin. Even so, it's hard to see at first just what Nichols wants with Squibb.

But he has his reasons. For one thing, Mathieson is already marketing sodium methylate and hydrazine as pharmaceutical intermediates, and Squibb could use Mathieson's hydrazine to produce an anti-tuberculosis drug. For another, Mathieson's petrochemical plant at Doe Run, Ky., could turn out still other starting materials for pharmaceuticals.

Will the deal be as successful as Mathieson's earlier expansions? Mathieson will have to fork over
(Continued on page 108)

"Irreplaceable You"

**Protect hard-to-replace
Metal Equipment with
INSUL-MASTIC
Protective Coatings**



You can help the scrap drive by collecting scrap, but not by *creating* it. So keep acids, alkalis and moisture from making scrap of your metal vessels and equipment . . . Coat them with INSUL-MASTIC *superior* coatings.

INSUL-MASTIC is the original Gilsonite coating. The one which proved the great resistance of Gilsonite to chemical attack. INSUL-MASTIC's binder contains 50% of this nearly inert mineral. Other coatings contain about 5% . . . or just enough to mention.

This is only one of the marks of *superior* quality which has made INSUL-MASTIC the leader among coatings. The very high percentage of mica flake is another one. Mica flake helps to give INSUL-MASTIC *superior* coatings their exceptionally long life. And when you specify a coating, you want *long life*.

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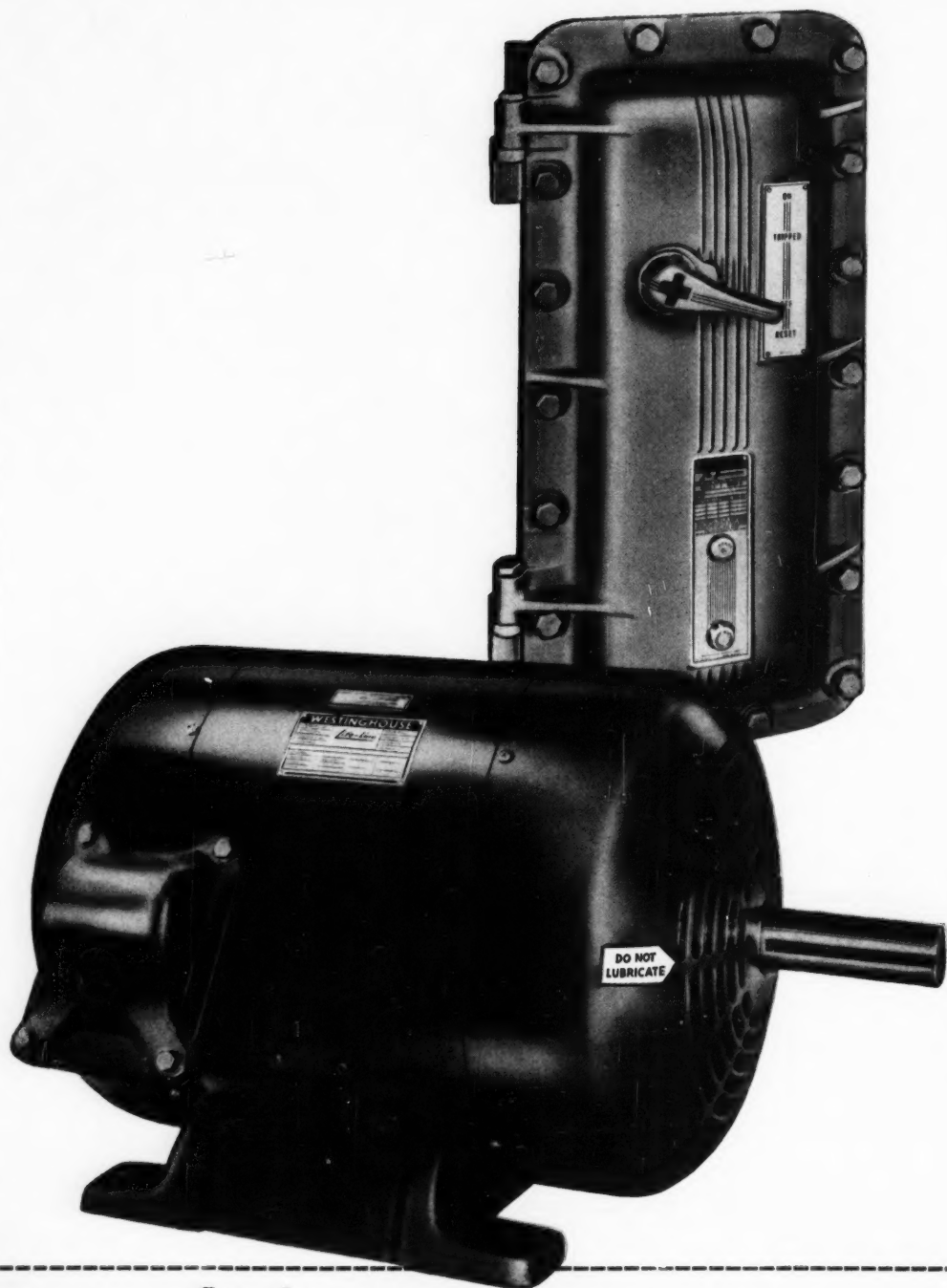
When writing your coating specifications remember it will pay you to give utmost protection to your vessels and equipment by choosing the leader among coatings. Specify INSUL-MASTIC by name.

Think first of the coatings that last!

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And here's the equipment to do it

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In any location where Class II, Group G, or Class I, Group D explosive materials present a hazard, you can operate this Life-Line explosion-proof motor safely. It's underwriter approved for *both* explosive dusts and explosive vapors.

And the Life-Line offers extra protection against outages. Heavy steel construction provides greatest protection against physical damage. Pre-lubricated bearings need no further lubrication . . . eliminate outages due to faulty greasing. Superior winding techniques and insulation reduce electrical failures. Together they add up to longer life . . . less servicing.

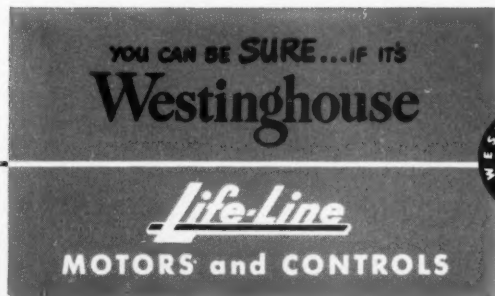
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Bi-metal overload relay protection and AB Circuit Breakers cut down time. In case of fault, no need to remove cover to reset breaker or overload relay mechanism. Service is restored immediately.

Simple design, single operation mean fewer operating parts to foul. Seesaw action of clapper prevents accidental operation. Kickout spring assures positive opening. Exclusive "De-ion" arc quenching plus silver-to-silver contacts eliminates contact filing. Compare any other starter and see why Life-Lines offer more service with less servicing.

Together Life-Line motors and starters offer the food industry a new concept in performance. You get more service on the job . . . less down time and servicing. Ask your Westinghouse representative for complete details on both, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21701



THE CHEMENTATOR, continued

to Squibb stockholders more than 2.2 million shares of Mathieson common. At a market value of \$45 a share, that's about \$103.4 million.

That price looks about right compared with Squibb's record earnings in the last two years; it's 10.6 times the 1951 earnings, and 12.8 times 1950. Compared with other postwar years, however, the price Mathieson is willing to pay looks a lot higher. It's over 15 times the Squibb net in 1949; and 21.5 times greater than average annual earnings in 1946-1948.

Moreover, Squibb's earnings for the 1952 fiscal year ended June 30 fell far short of 1950 and 1951. In fact, 1952 was probably closer to 1949. Second-quarter profits in fiscal 1952 were off 34 percent from a year ago; for the third quarter, profits were down 28 percent. It may be a long time before Squibb equals its 1950 and 1951 earnings. The current glut of penicillin, dwindling export markets and increasing competition from specialties like aureomycin and terramycin have bobbed Squibb's antibiotic profits.

Last year, on sales over \$100 million, Squibb earned \$9,704,801, up 20 percent from 1950. That's equal to \$2.30 a share on 3,827,708 shares of common. In the nine months to March 31, 1952, Squibb chalked up sales of \$76 million for a net equal to \$1.23 a share.

As for Mathieson, last year it was one of the few big corporations to show a profit gain (6 percent) despite a 65 percent jump in taxes. Mathieson's sales in 1951 were \$91 million and earnings \$9,653,000 for a net of \$3.56 a share. So far this year Mathieson's operations have been more profitable than those of the chemical industry generally. For the first half of 1952, Mathieson reported sales of \$61 million and net profits equal to \$1.63 a share on 3,142,754 shares.

Monsanto eyes atomic power

Production of electric power from atomic reactors with simultaneous manufacture of plutonium is not far away, prophesies Edwin J. Putzell, Jr., secretary of Monsanto Chemical Co., although it is "perhaps four or five years away, measured in terms of full-scale producing units."

After a year of AEC-sponsored research a team from Monsanto and Union Electric Co. of Missouri concludes that a moderated Hanford reactor can produce both plutonium and power economically. Monsanto and Union Electric are urging the AEC to build a pilot plant, with the companies participating in its design, construction and operation.

Monsanto is interested in atomic power for three reasons. First, the operation of nuclear reactors is essentially chemical engineering. Second, Monsanto uses tremendous quantities of electric power in producing such chemicals as chlorine, caustic and elemental phosphorus. Last year, its electric bill for U. S. manufacturing operations was over \$7 million. Third, Mon-

santo believes it can produce more and cheaper plutonium for the government.

A decade may elapse before a reactor making only electricity becomes a reality. Meantime, Monsanto is exploring with the AEC the possibility of an agreement under which private industry could construct and operate a reactor producing both power and plutonium, with the government getting the plutonium at an agreed price.

Uranium from phosphate rock

An agreement has been reached by Stauffer Chemical, American Smelting & Refining and Kennecott Copper to build and operate a plant near Salt Lake City that will produce about 60,000 tons a year of concentrated phosphate fertilizers. The plant will make phosphoric acid by the wet process, with recovery of uranium and vanadium contemplated.

Capital outlay will be close to \$5 million. Construction is just getting started at the 600-acre site. The plant is expected to go into operation during the summer of 1953.

Phosphate rock will come from Stauffer's big deposits in Wyoming and Idaho. Garfield Chemical will furnish sulphuric acid from its Salt Lake City plant, currently being expanded. Additional sulphuric will come from AS&R's smelter gases, eliminating the need for scarce sulphur.

Kingpin: Kaiser's Mead plant

The Mead, Wash., reduction plant of Kaiser Aluminum & Chemical Corp. has become the nation's largest. An eighth pot line, which can turn out about 44 million pounds of primary aluminum annually, is now in operation. It boosts total capacity to a hefty 350 million pounds a year.

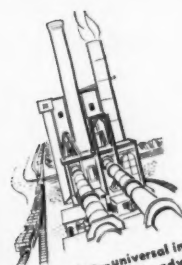
This is the second pot line to be installed at the Mead plant near Spokane as part of a \$12.5 million expansion that has added nearly 100 million pounds of new aluminum capacity in 18 months. Built during World War II, the plant originally had six pot lines.

The Mead expansion should be completed by the end of this year. It will include a fume control system, with hoods covering each of the plant's more than 1,100 pots. Fans will draw off fumes and smoke, first into settling chambers where dust and dirt are removed, and then into washing towers where fluorine gas is dissolved in water.

Already completed is a unique cryolite recovery plant, only one of its kind in the U. S. It's expected to recover from discarded pot linings up to 50 percent of the plant's cryolite needs. Another new unit will be a carbon baking furnace that will supply the plant's requirement of about 12,000 lb. of carbon each month.

Expansion of its Mead plant is part of Kaiser's program to more than double its aluminum capacity by mid-1953 to about 816 million pounds a year. The

(Continued on page 110)



Worm gearing—universal in its application—affords advantages for almost every power transmission job.

The Cleveland-driven conveyor shown here is feeding dolomite into a rotary kiln at the Basic Refractories Plant at Maple Grove, Ohio.

Steady CLEVELAND drive keeps dolomite rolling along

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Speed Reducers



THE CHEMENTATOR, continued

plan calls for stepping up output of present plants and the construction of a new plant with eight pot lines at Chalmette, La., near New Orleans, capable of turning out 400 million pounds a year.

New way to make ammonium nitrate

Commercial Solvents has come up with a new continuous process for making substantially dry ammonium nitrate in a single step (see p. 215). Far safer than previous processes, it's cheaper and more efficient too. Separate neutralization, evaporation and final drying steps are eliminated.

First commercial plant is now going up near Sterlington, La., where the basic materials, anhydrous ammonia and nitric acid, are already being made by Commercial Solvents. The new ammonium nitrate plant will be completed by mid-1953.

Leonard A. Stengel of CSC's research laboratory in Terre Haute, Ind., developed the process. A pilot plant has been in operation at Sterlington for a year.

Up to now, manufacturers have shied away from commercial production of ammonium nitrate by direct reaction of ammonia and nitric acid at high temperatures. With the Stengel process, this can now be done at little risk. The short stay of only small amounts of material in the reactor greatly reduces the hazard of explosion.

Other advantages of the new Stengel process: (1) a plant costs less; (2) it takes less time to build a plant since the process is simpler; (3) operating costs are lower; and (4) particle size of the ammonium nitrate product can be varied to meet requirements.

Break for users of chemical tank cars

The increase in mileage allowance from 2.2 c. to 3 c. per mile just granted by the railroads to users of private tank cars will mean about \$3 million annual savings to the chemical industry alone, according to J. W. Brown, chairman of the tank car advisory subcommittee of MCA's traffic committee.

The increase will apply to some 30,000 tank cars now in chemical service, Brown says, as well as to more than 80,000 cars carrying petroleum products. An increase from 2.25 c. to 3.2 c. was also granted for hopper cars.

The mileage allowance is the method used by the railroads to compensate shippers who provide their own cars, since freight rates include provision for amortization and maintenance of rolling stock.

More than a year ago the MCA, together with the American Petroleum Institute and the companies leasing tank cars, filed an application with the railroads for the increase in allowance just granted. The move recognizes for the first time that the tank itself is part of the car, and that mileage allowance should not be limited to the running gear alone.

Iso-octyl alcohol by Oxo process

NEW PLANT—In a new plant at its Port Arthur, Tex., refinery Gulf Oil Corp. will make iso-octyl alcohol. From a heptene olefin, carbon monoxide and hydrogen, Gulf will first get iso-octaldehyde. A present refinery unit will be converted into the reactor for this step. The aldehyde will be hydrogenated to iso-octyl alcohol in a new unit now being built.

GERMAN PROCESS—Gulf's synthesis will be carried out by the Oxo process, developed by the Germans during World War II for making primary alcohols from olefins.

The Oxo process is a relatively high-pressure, low-temperature process in which cobalt catalysts are usually employed.

HOW IT WORKS—The Germans first reacted an olefin with carbon monoxide and hydrogen in the presence of a Fischer-Tropsch catalyst (cobalt, thorium and magnesia on kieselguhr) at about 250-300 deg. F. and 4,000 psi. This step produces an aldehyde with one more carbon atom than the starting olefin. Next, this aldehyde is hydrogenated to the alcohol.

CATALYSTS—Work in the U. S. has established either cobalt hydrocarbonyl or di-cobalt octacarbonyl as the most active catalyst for the first or Oxo stage of the process. These catalysts are readily made from any cobalt salt or from the activated metal.

U. S. INTEREST—Many petroleum and chemical companies in the United States are working on the Oxo process. So far, three commercial plants are operating and others are under construction. This gives an idea of growing interest in the process.

First commercial unit for production of iso-octyl alcohol was put on stream by Esso Standard at Baton Rouge in 1949. This is a redesigned high-pressure (3,000 psi.) hydrogenation unit. Standard of Indiana is also revamping high-pressure equipment to make iso-octyl alcohol.

At its Wood River, Ill., refinery, Standard of Indiana will add a large iso-octyl alcohol plant to produce about 10 million pounds a year. It will be built by M. W. Kellogg.

The plant will have three basic units: (1) a fractionating system for getting heptene as a "heart cut" from an olefin feedstock; (2) a refinery gas reformer to make hydrogen and carbon monoxide; and (3) the actual iso-octyl alcohol unit, where the heptene, hydrogen and carbon monoxide will be synthesized into the end product. Process design of the iso-octyl alcohol unit will be Standard's own, while the other two units will be designed by Kellogg.

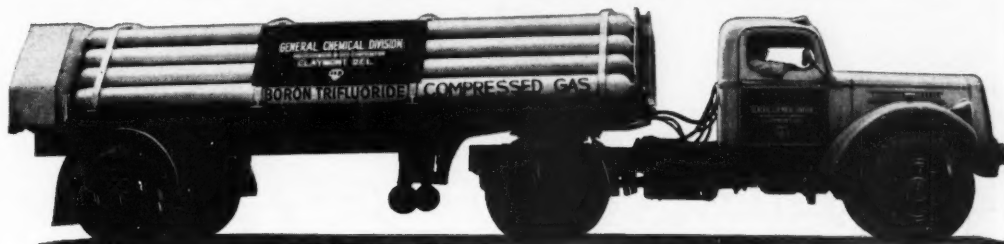
Other plants using the Oxo process are Du Pont's Belle, W. Va., plant, where trimethyl hexanol is made from di-isobutylene, and Texas Eastman's Longview plant, where butyraldehydes are produced for conversion at Kingsport, Tenn., to the alcohols and acids. Butyric acid is used by Tennessee Eastman in cellulose acetate butyrate plastics. —End

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Today, the catalytic properties of Boron Trifluoride . . . both as a compressed gas and in its various complexes . . . are being utilized in many major industrial fields. These include petroleum, synthetic rubber, resins, solvents, plastics, dyestuffs, metallurgy, etc. With it, many hitherto impossible operating problems involving organic reactions are being solved.

To meet every processing need, General Chemical produces Boron Trifluoride both as a gas and in a wide range of complexes. Recently, General began regularly-scheduled tonnage shipments of the compressed gas by tank truck, marking another milestone in the expanding use of this new industrial chemical.

Listed at the right are many of the reactions in which General's BF_3 is now being utilized. If your operations involve these or similar techniques, you may find it advantageous to investigate Boron Trifluoride and its complexes.

For further information, for experimental samples of any of the products listed, or for confidential discussion of your particular needs, consult the nearest General Chemical office serving you.

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Uses of BF_3 as a
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Other Complexes

In addition, extensive research and production facilities place General Chemical in a preferred position to work with you in development of other BF_3 complexes to meet individual specifications.

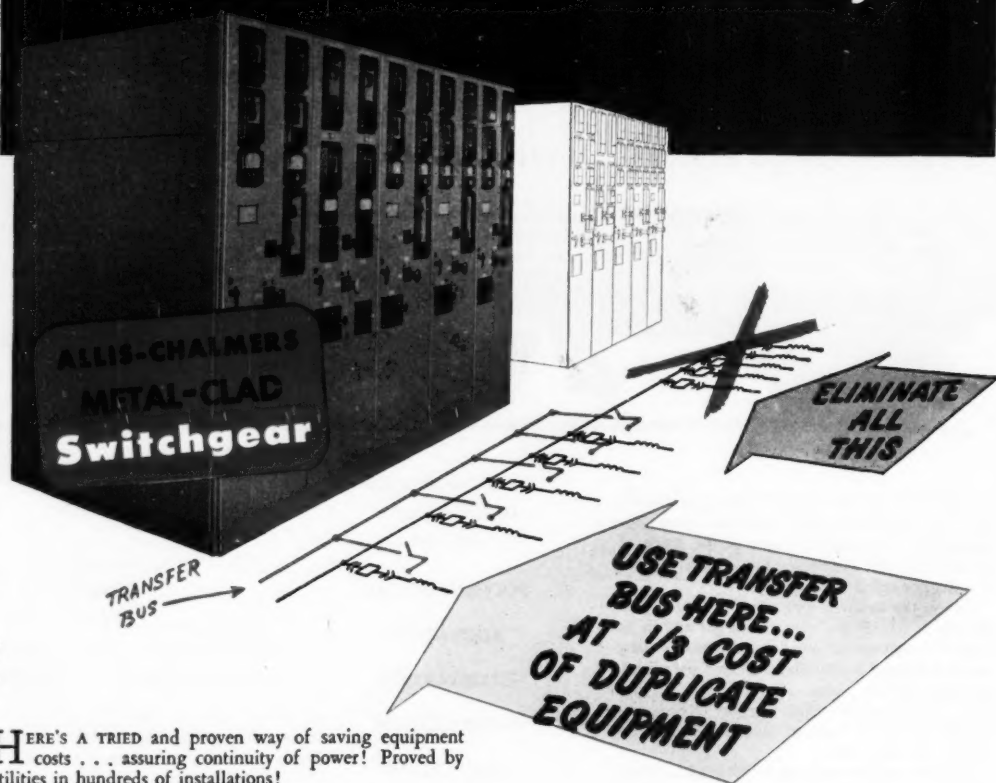
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It's simply a by-pass bus circuit that parallels the main switchgear bus. A switching means is provided so that loads can be transferred to the transfer bus. It's a standby in case anything happens to the main bus. Also, makes it possible to withdraw and maintain circuit breakers, or inspect main bus without power stoppage.

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Ask an Allis-Chalmers engineer about transfer bus arrangements and what they can mean to your plant in savings and service. Call your nearby Allis-Chalmers district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3731

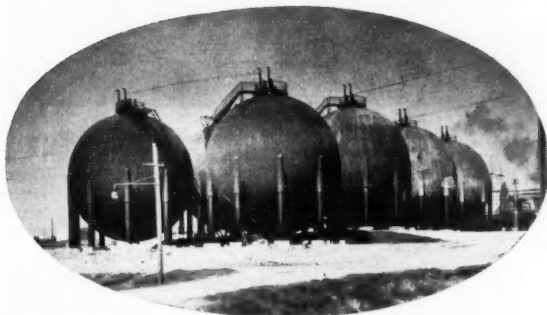
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STORING NITROGEN PRODUCTS for LION OIL



Some of the 10 Hortonspheres built by Chicago Bridge & Iron Company to store anhydrous ammonia under 75 lbs. per sq. in. pressure at the Lion Oil Company's chemical plant in El Dorado, Arkansas.

Nitrogen end products—anhydrous ammonia, ammonium nitrate fertilizer, sulphate of ammonia, and sulphuric acid—are vital to agriculture and to many manufacturing processes. Lion Oil Company's petrochemical plant near El Dorado, Arkansas, turns these products out at the rate of almost 1200 tons a day.

Due to the volatile or corrosive nature of some nitrogen end products, Lion Oil has installed special storage facilities like the Hortonspheres and the Horton stainless-clad steel tanks shown in the accompanying views.

The Hortonspheres are used to store anhydrous ammonia under 75 lbs. per sq. in. pressure. The combination of pressure and insulation greatly reduces the amount of vaporization that takes place in the tanks.

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Los Angeles 17.....1505 General Petroleum Bldg.
New York 6.....3318—165 Broadway Bldg.

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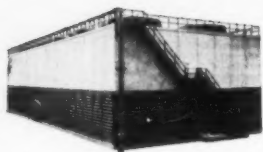


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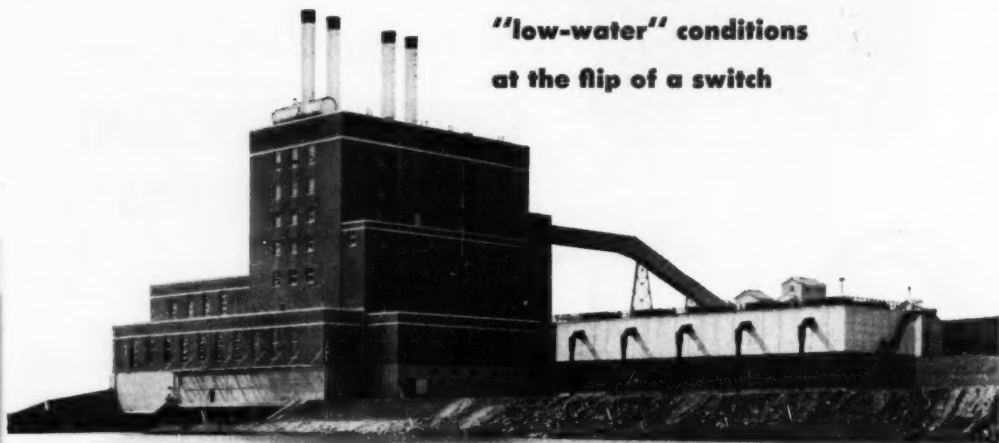


STAINLESS STEEL ELBOWS—32 Type 304, 307, 316, fabricated in 0.5, 1, 2, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 30, 36, 42, 48, 60, 72, 84, 96, 108, 120, 144, 168, 192, 216, 240, 270, 300, 324, 360, 420, 480, 540, 600, 660, 720, 780, 840, 900, 960, 1020, 1080, 1140, 1200, 1260, 1320, 1380, 1440, 1500, 1560, 1620, 1680, 1740, 1800, 1860, 1920, 1980, 2040, 2100, 2160, 2220, 2280, 2340, 2400, 2460, 2520, 2580, 2640, 2700, 2760, 2820, 2880, 2940, 3000, 3060, 3120, 3180, 3240, 3300, 3360, 3420, 3480, 3540, 3600, 3660, 3720, 3780, 3840, 3900, 3960, 4020, 4080, 4140, 4200, 4260, 4320, 4380, 4440, 4500, 4560, 4620, 4680, 4740, 4800, 4860, 4920, 4980, 5040, 5100, 5160, 5220, 5280, 5340, 5400, 5460, 5520, 5580, 5640, 5700, 5760, 5820, 5880, 5940, 6000, 6060, 6120, 6180, 6240, 6300, 6360, 6420, 6480, 6540, 6600, 6660, 6720, 6780, 6840, 6900, 6960, 7020, 7080, 7140, 7200, 7260, 7320, 7380, 7440, 7500, 7560, 7620, 7680, 7740, 7800, 7860, 7920, 7980, 8040, 8100, 8160, 8220, 8280, 8340, 8400, 8460, 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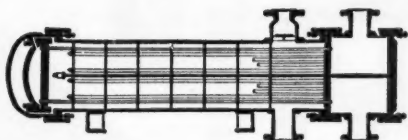
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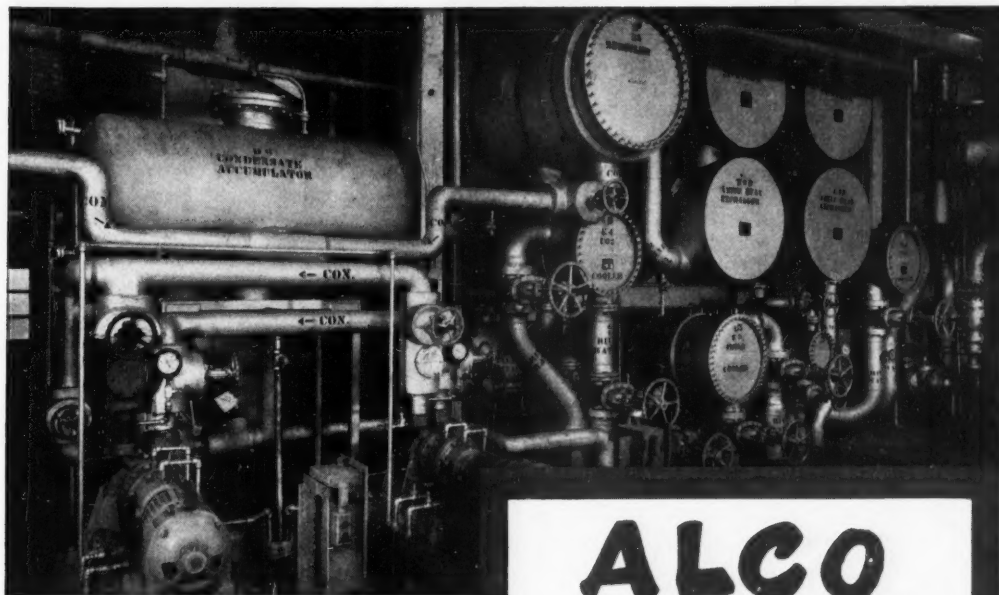


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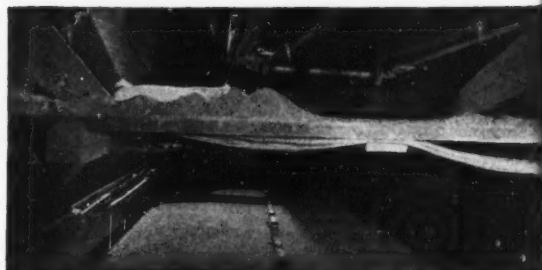
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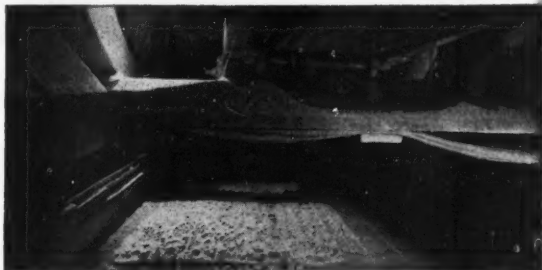
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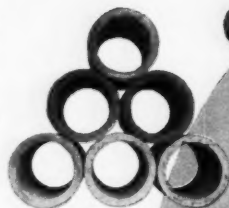
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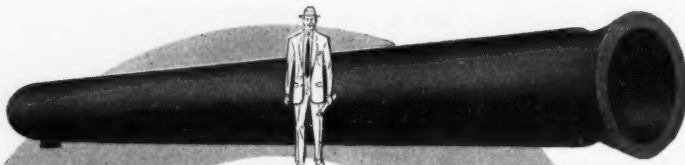
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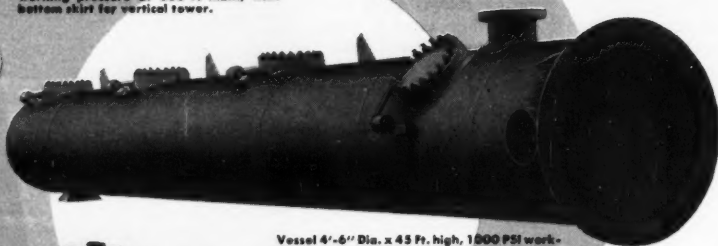
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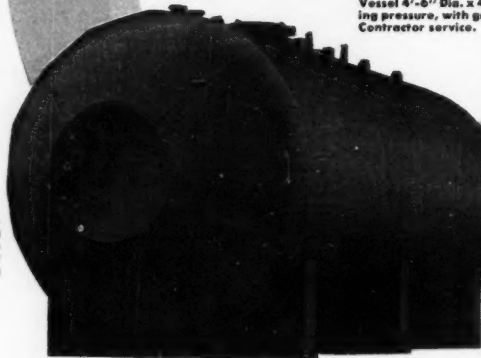
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Vessel 4'-6" Dia. x 45 Ft. high, 1000 PSI working pressure, with grating and screen trays for Contractor service.



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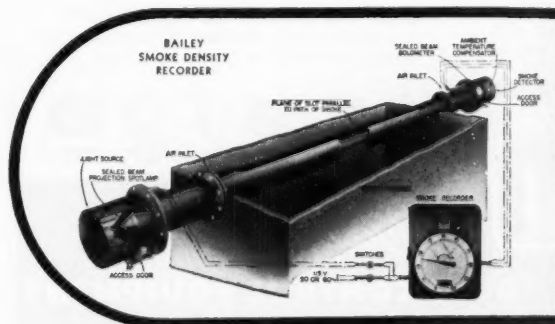
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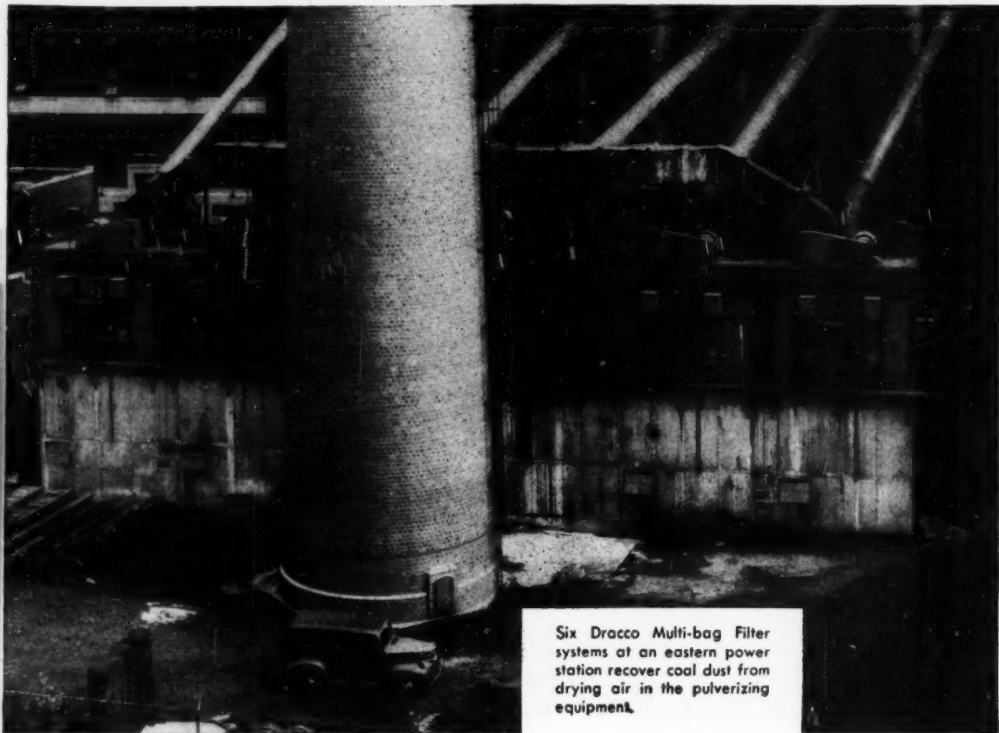


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The efficient, cost-saving performance of this

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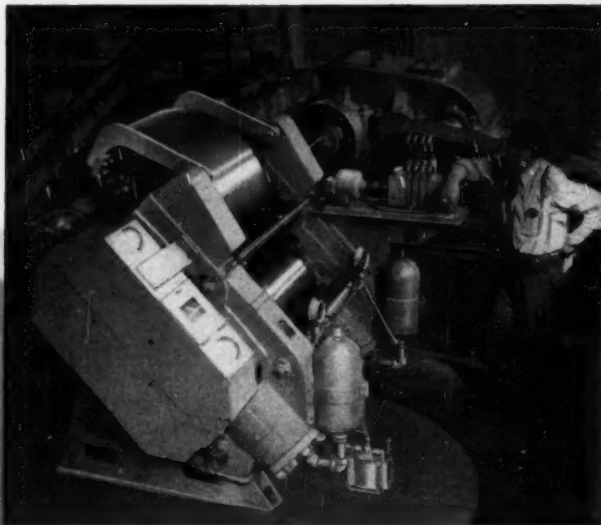
Glycerine is safe to use . . . widely applicable . . . in full supply! It helps maintain the marketability of old formulae . . . and contributes sales-building advantages in new brands of cosmetics or toilet goods. Why not review some of these advantages? Write for your copy of "Why Glycerine for Drugs and Cosmetics?"

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The Stacomizer

A NEW CONTINUOUS PROCESS FOR DEWATERING



Removes 70 to 85% of moisture from most materials

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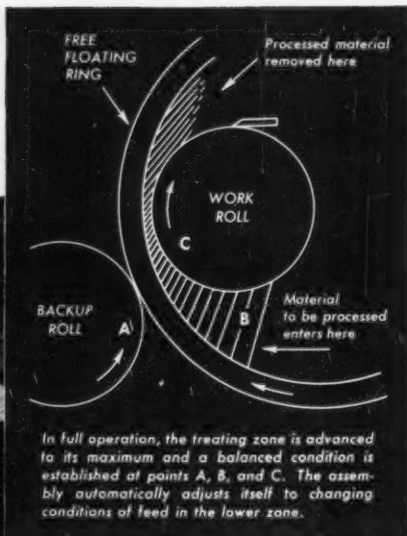
The Stacomizer is now available in four sizes with hydraulic pressures ranging from 75 to 350 tons. Write for further information.

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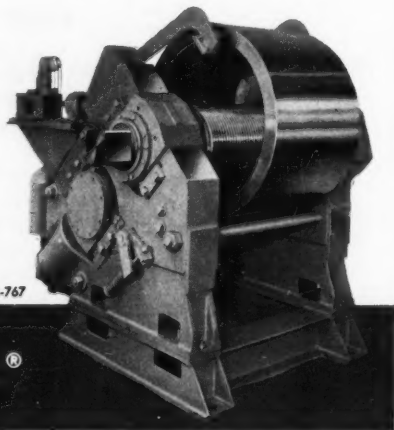


How the Stacomizer operates

The Stacomizer introduces a new fundamental mechanical principle to the processing of many kinds of materials. Essentially, it consists of three rotating members—a backup roll, a driven work roll, and a floating ring which revolves freely between the rolls. The rolls are loaded by hydraulic pressure.

The material to be processed is fed into the lower part of the floating ring and is carried upward into the horn angle formed by the work roll and the inside surface of the floating ring. As the material comes under pressure, the floating ring dips, and, acting as a lever, forces the rolls apart. This opens up the throat of the angle by advancing its apex above the horizontal plane of applied pressure.

The material is compressed into a blanket which is rolled through the assembly under extremely high pressures with a minimum of shear or grinding action. The extracted fluids are collected as they flow by gravity from the bottom of the floating ring. The processed material is removed by scrapers and conveyors.



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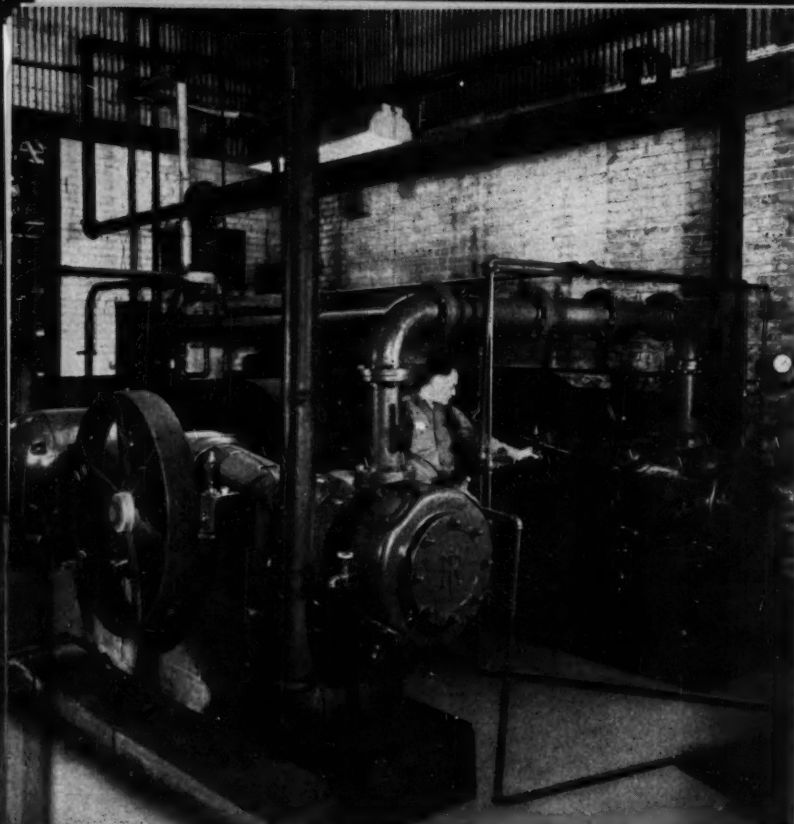
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Company.....

Address.....

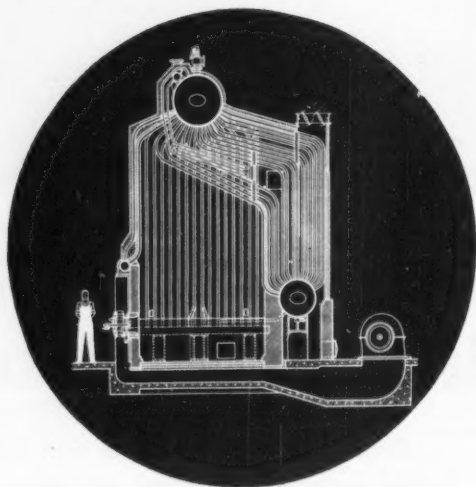
City.....Zone.....State.....

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Hosiery
Knitting Mills
Institutions
Laundries
Leather
Linoleum
Locomotive
Lumber
Machinery
Metal Producing
Mining
Municipal
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VU-10 Boiler — This oil or gas fired unit is in a Southwestern plant. Capacity — 60,000 lb of steam per hr; operating pressure — 150 psi; steam temperature — 465 F. VU-10 capacities range from 10,000 to 60,000 lb of steam per hr.

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pany, for instance, ordered its first VU in 1937; another was ordered in 1940, two more in 1942 and another in 1947. The sixth unit was installed in 1950. They know by actual experience what they can expect from a Vertical-Unit Boiler.

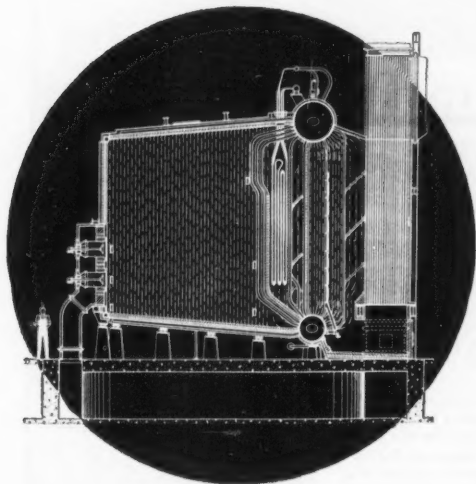
So, if you use steam . . . from 10,000 to 350,000 pounds per hour . . . for power or process, take your cue from the petroleum industry — or from any other field where steam is of primary importance. Investigate the lower steam costs you get with the advanced design . . . sound construction . . . consistent reliability of C-E Vertical-Unit Boilers.

Typical Group of Oil Companies that have purchased VU Boilers for one or more plants

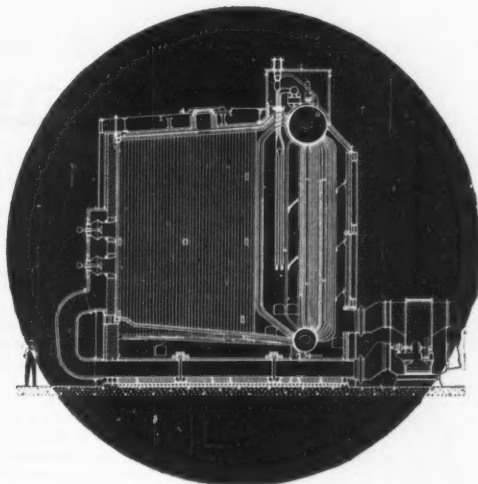
Arabian American Oil Company
Cit-Con Oil Corp.
Cities Service Refining Company
Creole Petroleum Corp.

Esso Refinadora do Petroleos
Gulf Oil Company
Humble Oil & Refining Company
Magnolia Petroleum Company
Pan American Refining Company
Petroleos Mexicanos

The Pure Oil Company
Sinclair Refining Company
Socony Vacuum Oil Company
Stanolind Oil & Gas Company



VU-50 Boiler — This unit is one of two duplicates at an Eastern plant. They are fired with oil or gas. Capacity — 100,000 lb of steam per hr; operating pressure 550 psi; steam temperature — 700 F.



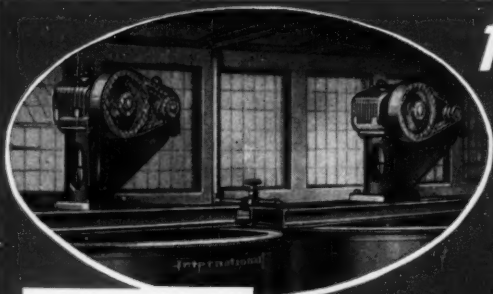
VU-50 Boiler — This is the latest of three duplicate units installed in this Western plant. Fired with oil or refinery gas. Capacity — 250,000 lb of steam per hr; operating pressure — 565 psi; steam temperature 650 F.

— SUPERHEATER, INC.

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B-571

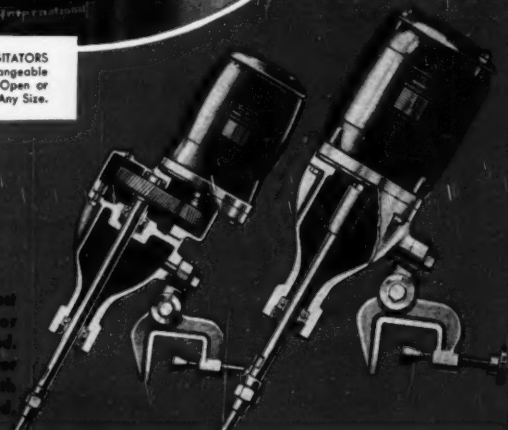


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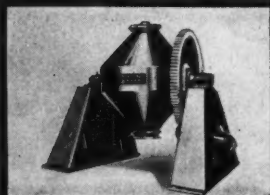


International *Complete Processing Systems*

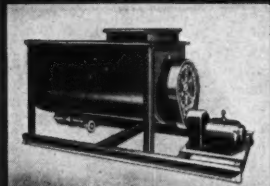
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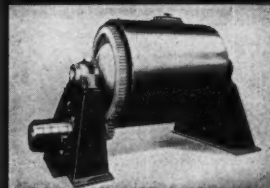
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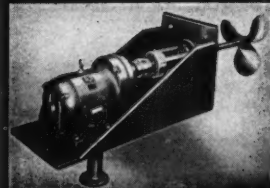
DRY BLENDERS
From 25 to 10,000 lbs.



RIBBON MIXERS
From 1/4 to 175 cu. ft.



BALL MILLS
Welded Steel Construction



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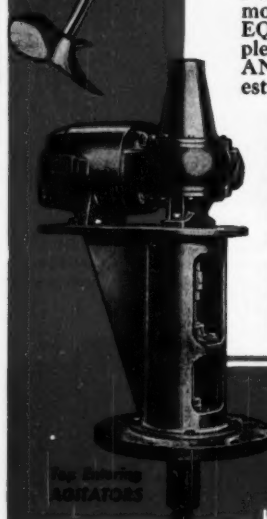


Fig. Entering
AGITATORS

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WOrth 2-2580 DISTRICT REPRESENTATIVES IN PRINCIPAL CITIES WAbash 2-0733

Memo from the Editor John R. Callahan



Chemical Engineering社社長、編輯長
（マックグロウヒル）

アメリカ化学雑誌の中で一番古い歴史を誇る「マックグロウヒル」を代表し、まして化学工業日報および日本におられる数々の諸君の好様に對しまして心から御礼を申し上げます

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有益な文化交流

ケミカル・エンジニアリング
ケミカル・ウィーク編集取締役

S・D・キルクパトリック

EDITORIAL DIRECTOR Sid Kirkpatrick recently made the back page (same as our front page) of Japan's *Daily Chemical News*. Here's his message to the Japanese chemical industry on the signing of the peace treaty. We'll tip you off on the secret: read from top to bottom, from right to left—and best of luck.

The Irish Among Us

I knew it would happen some day—and it was our June issue that touched the thing off. Now I know you can't have your first three articles tagged with names like O'Shaughnessy, O'Connor and Callahan and not hear about it. Not even in Boston, dammit.

For one smart Sam O'Toole up in that Gaelic hole picked it up, tried to get our dander up by wanting to know how come.

"Sure," he says, "and just look at the disgraceful names of some of your editors: O'Brien, O'Connor, Kirkpatrick, McBride, Byrnes, Bryant, Cronan, Callahan. What's the racket?"

It's not a racket—just chance. Irish chance, of course.

Besides, President McGraw once told me he didn't give a damn how many of us he had in his Big Green Building.

And you should see the colleens we've got around here!

Adsorption Down-to-Earth

Ever felt that you don't know quite as much as you'd like about adsorption, that you've never been

able to get just how and why it's used in chemical operations?

Then you'll be interested in our October report, a six-article symposium on adsorption. It'll cover fundamentals as well as latest developments in principles, applications, equipment and design. All aimed at the practical engineer and at his working level. Here's a quick run-down of what you can expect:

Bob Treybal of New York University will start the ball rolling by asking—and answering—the question: What is adsorption? He compares it, by using analogs, with such familiar operations as distillation and absorption.

Then Leon Lapidus of Princeton will discuss fundamentals and bring theory down to practice. He'll deal with such things as equilibria, rates, mechanisms.

Foster Wheeler's Bob Merims will then take up design features of both moving and fixed-bed adsorption units. Here again, the pitch will be on the practical aspects.

Adsorption from the gas phase will be handled by Frank Browning of Carbide. This section will cover equipment, principles of operations, adsorbents used, applications. Walter Helbig of Atlas Powder will give the

same type of treatment to adsorption from the liquid phase.

Finally, consultant Charles Mantell (who's specialized in adsorption for many years) will give a brief run-down on what's ahead in the field.

This report, we believe, will be meat to those engineers who want to know more about adsorption and how it's being practiced. But don't expect a lot of theory or a mass of details.

Are Your Issues Late?

Chances are they are. And every so often somebody writes in and complains about it. I don't blame them; I'd do the same. But here's why it happens.

Your copy of *Chemical Engineering* is mailed from Albany, N. Y. (where it's printed) on the 20th or 21st of each month. It goes out as second-class matter, just as practically all magazines do. Other classes of mail are much more expensive, some of them prohibitively so.

But about a year or so ago the Post Office people adopted the policy of giving handling preference to the higher-rate matter, which is understandable. One of the reasons, as I get it, was that the PO's operating and personnel budget had been cut sharply.

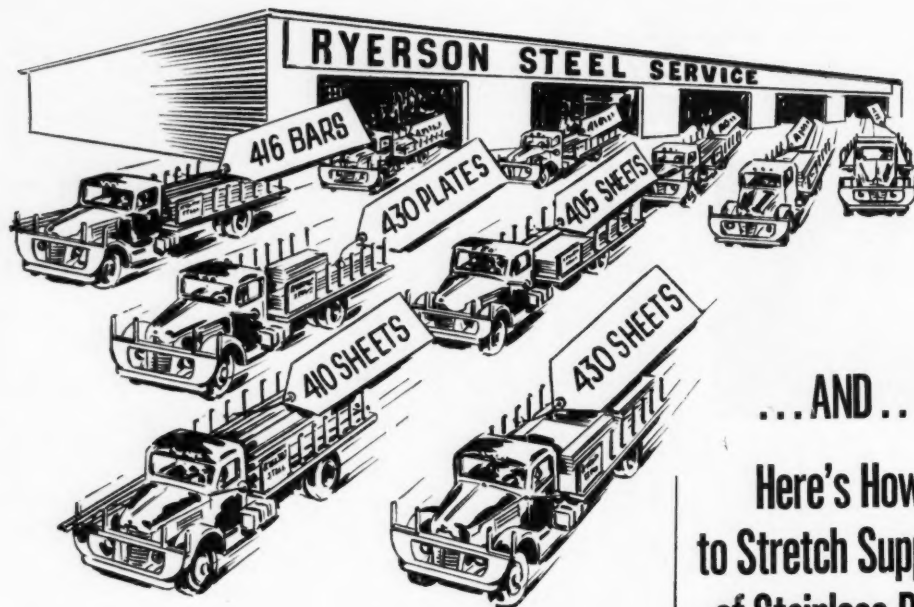
Net result is that your copy of CE often lies around at some post office for days before it is sent on to the next distributing center. Then the same thing may happen again. It may even be in your home town post office for days or a week before it's finally delivered to you.

If your copy goes through several handlings or distributing points—and that depends pretty much on where you live—then it may often be two weeks or more before you get it.

Just as an example: It took 13 days for my June issue to reach me in New Jersey, less than 150 miles from where it was mailed. The Pony Express could have done it in two days!

Can we do anything about this whole problem? I think we can and we've certainly been studying all the angles long and hard.

So if you'll continue to bear with us, I believe that by next year you'll be getting your copies of CE much earlier. We'll appreciate your patience.



...AND...

Here's How to Stretch Supplies of Stainless Pipe

Here's an example of how you can secure additional footages of stainless pipe during this period when nickel is short and allotments cut to the bone:

You can buy 280 feet of 4" Schedule 5 (light wall) stainless pipe on the same nickel bearing stainless allotment required to buy approximately 100 feet of Schedule 40 (standard) stainless pipe of the same size. Or if you prefer a slightly heavier wall, you can buy 195 feet of Schedule 10 pipe on the same allotment. Either way you can increase your footage whenever Schedule 5 or Schedule 10 pipe will do the job.

It's very possible that our experienced stainless specialists may be able to suggest ways to stretch the stainless supplies allotted to your specific operation. Consult them freely without obligation.

★ ★ ★

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If you are looking for a metal to replace nickel-bearing steels, we urge you to consult our stainless specialists. Then draw on our large stocks of straight chrome types. A special technical bulletin on chrome stainless alternates for various applications of 18-8 stainless has just been published. Write for your copy.

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Chemical Engineering

WITH CHEMICAL & METALLURGICAL ENGINEERING

AUGUST 1952

Challenging Opportunities Ahead

The next few decades will be a period of tremendous challenges to all chemical engineers.

For they will be called upon—as never before—to develop economical raw materials, processes and products to stretch and bolster the nation's dwindling supply of key materials.

Emphasis will be placed on synthetic chemical materials. But the real challenges will be much broader than the chemical industry alone, broader than the chemical process industries as we know them today. They will go over into and perhaps focus on the very bases of our economy; minerals, agricultural products, fuels and energy, metals, forest products, materials of construction, water, the soil.

That's the message—the real message—of the President's Materials Policy Commission. The commission's five-volume report, now generally referred to as the Paley report after Chairman William S. Paley, was put out in late June.

Taking a broad, long-range view, the commission finds this country, and the entire free world, threatened with a shortage of many key materials. It points out that consumption of almost all materials is increasing at compound rates and is thus pressing harder and harder against our resources.

But absolute shortages are not the threat:

"The threat of the materials problem lies in insiduously rising costs which can undermine our rising standard of living, impair the dynamic quality of American capitalism, and weaken the economic foundations of national security."

Then the commission, which is seriously concerned but not alarmist in its outlook, goes on to state the challenge:

"The central challenge . . . is therefore to meet our expanding demands with expanding supplies while averting a rise in real cost per unit."

The threat of "real costs," then, is the crux of the matter. And this means that chemical engineers—and all engineers—must become, more than ever, conscious of costs. For they will be called upon, as never

before, to shave dollars-and-cents from the costs of raw materials, processes, energy and labor.

The President's commission makes it plain that it looks to chemical methods and to chemical engineering techniques for the solution to many of the nation's materials problems.

But what are some of the problems the chemical engineer can expect to be called upon to solve within the quarter century? What will be his challenges, hence his opportunities?

His first big challenge—and it is one that has already become evident—will come from the fields of ore treating and metallurgy. Here he will be asked to put chemical engineering to work to develop new and better ways to extract minerals and metals from low-grade ores. For by 1975, "demands for minerals as a whole . . . will almost double."

He will be called upon to extend our forest resources. "Only about 65 percent of the average tree that is cut ends up as useful material."

He will be asked to help increase the output of agricultural products "for demand by 1975 will rise about 40 percent." And to develop ways to upgrade and use our vast tonnages of agricultural wastes.

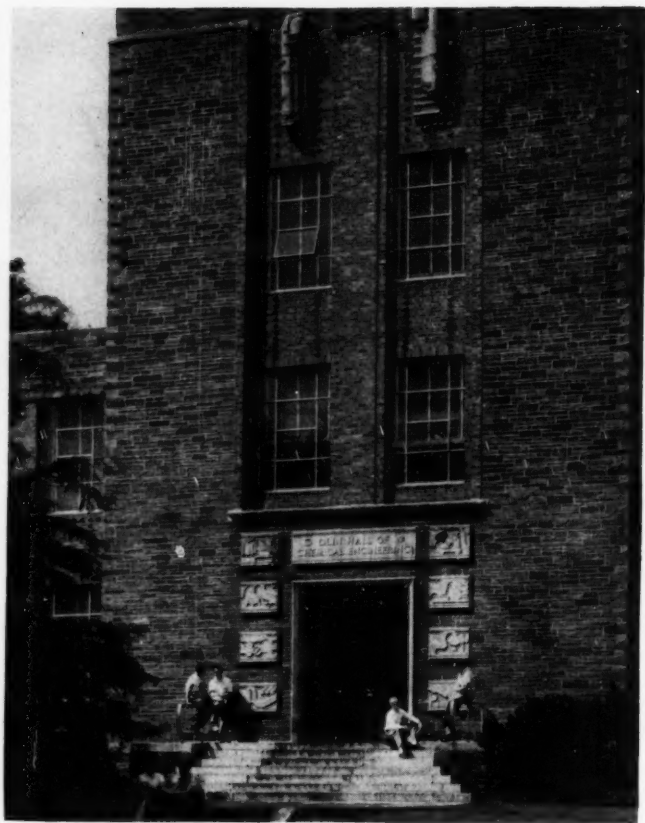
He will be expected to conserve energy and to extend our energy resources: "Demand for energy in all forms will double."

He will be forced to recycle water and to use less of it: "Demand for industrial water will increase roughly 170 percent."

He will be urged to do more about controlling corrosion—an insidious waste that now costs the U.S. some \$8 billion every year.

For the well-trained chemical engineer with imagination, ingenuity and courage, the next quarter century will be loaded with real challenges—challenging opportunities to help our nation and the free world keep its vitality and freedom.

John R. Callahan



CHEMICAL ENGINEERING SCHOOLS NOW LET . . .

Profs Pull Double Load

- University Research Potential Is Almost Saturated
- Use of All Resources Would Mean a 12% Increase
- Any Step-Up Ought Not Be at Teaching's Expense

JOHN I. MATTILL

Chemical engineers in colleges and universities are as research-conscious as their colleagues in industry.

Better than 8 out of every 10 qualified chemical engineers on American college faculties have research work in progress—a proportion higher than in any other of the physical and engineering sciences. The total of these studies

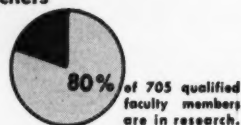
John I. Mattill is Assistant Director of the News Service, Massachusetts Institute of Technology; and Secretary, Engineering College Research Council, on leave.

is equivalent to the work of a full-time senior research staff of 280.

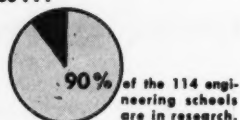
Some 1,700 assistants and graduate students in chemical engineering are doing research; output equals the work of 800 full-time junior researchers.

A recent national inventory by the Engineering College Research Council shows that 701 chemical engineers on faculties of 114 colleges and universities are considered qualified for research; 564 in 102 institutions now have studies underway. At 94 schools, graduate students and junior staff members too are on this team.

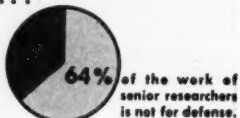
Researchers



Facilities . . .



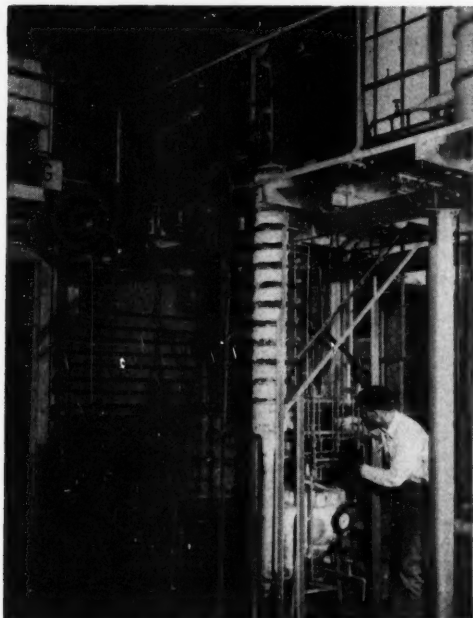
Efforts . . .



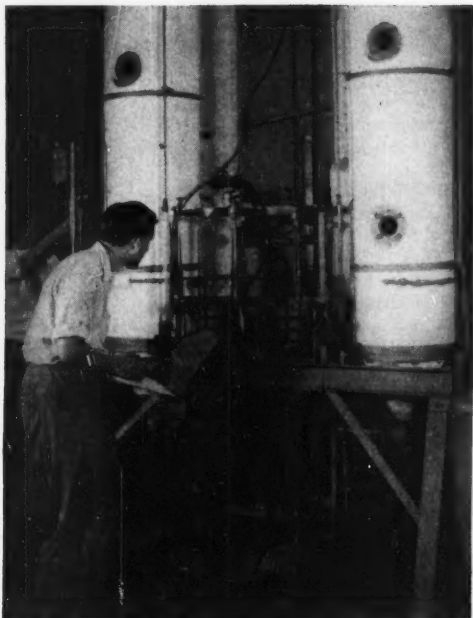
There seems little chance of increasing this prodigious research volume. For there remains an untapped resource of only 135 chemical engineering faculty members in colleges and universities who are qualified for research and who now have no assignments. If all these take on quarter-time studies, total college and university research output in chemical engineering may go up by 12 percent.

No new manpower is likely to be added to most college staffs until required by the demands of teaching.

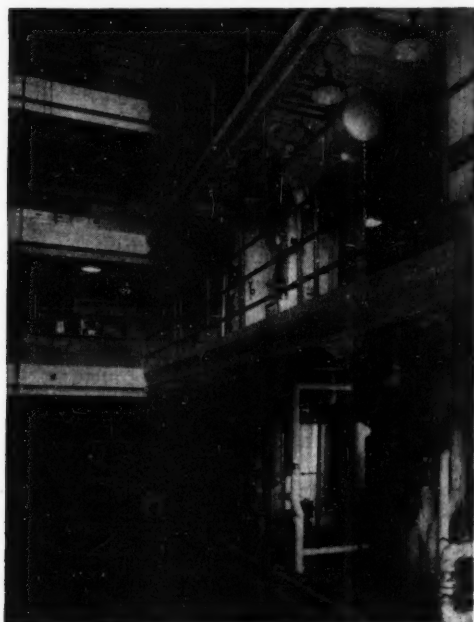
These four schools have 45% of the defense contracts



GEORGIA TECH: Part of unit operations laboratory.



CORNELL: Evaporator in the chemical engineering laboratory.



ILLINOIS: Unit operations laboratory, one of the best.



MICHIGAN: Basic research in fuel sprays for the Air Force.

And engineering enrollments are beginning a predicted slump which will not encourage faculty expansion for several years at least.

But there are small holes in the research pattern. And there is a comparatively vast reserve of college and university research potential in chemistry, some of which may be turned to meet the increasing engineering research needs of the industry.

This picture of chemical engineering research in educational institutions comes from an analysis of a national inventory of college and university research resources by the Engineering College Research Council, a unit of the American Society for Engineering Education. The study was made by the Council's Committee on Relations with Military Research Agencies, at the request and with the active cooperation of the Research and Development Board in the Office of the Secretary of Defense.

COVERS OVER 48,000 SCIENTISTS

In all, this national inventory centered on the special interests and activities of faculty and graduate students in all physical and engineering sciences at 750 colleges and universities in the United States. Over 24,000 faculty members, and an equal number of graduate students, were reported.

The committee believes that "substantially all" of the national potential for research in colleges and universities in the physical and engineering sciences has been inventoried.

Of the nearly 25,000 faculty members reported in all fields of physical and engineering sciences, 20,000 are considered by their institutions to be qualified to perform research, but only 12,700 are now active in research. An average of 27 percent of the time of faculty members reported is spent on research activities, and on a national average 45 percent of this research time is already spent on defense research studies sponsored by military agencies or their industrial contractors.

"Putting these figures another way," Dean A. F. Spilhaus of the University of Minnesota, chairman of the committee, has pointed out, "of the 25,000 faculty members reported, one-half are active in research; these spend about one-half of their time in research, and one-half of this is devoted

to military research. This means that one-eighth of the total college effort in these fields of engineering and physical sciences is already devoted to defense research."

RESEARCH APLENTY RIGHT NOW

In the case of chemical engineering, the Council's figures show:

- A total of 735 faculty members and senior research staffs at 114 schools.

- Of these, 701 are judged, by their institutions, qualified to participate in research projects.

- At least 564 of these now have research underway.

- Their research is equivalent to the work of a full-time research staff of 279.8.

- Of these "equivalents," 99.4 would be engaged in defense projects for military agencies or their industrial subcontractors.

- At 94 of these schools, 1,699 graduate students and junior staff members have research underway.

- Their research is equivalent to the full-time work of a junior research staff of 807.4.

Chemical engineers account for only 3 percent of all the physical and engineering scientists on college and university faculties; they are doing 4 percent of all college and university research in these fields. These scientists are apparently "research conscious"—they appreciate the professional value of research to both teachers and students. At least 81 percent of all chemical engineers qualified are active in research—as pointed out above the highest research participation in any of the physical or engineering sciences. (Ceramic engineers rank second; 78 percent of those qualified among the latter are now engaged in research.)

STUDENTS, TOO ARE IMPORTANT

The volume of chemical engineering research conducted in colleges and universities equals that of each of the other four principal engineering sciences—aeronautical, civil and sanitary, electrical, and mechanical. But only in aeronautical does the percentage of faculty participation approach that of the chemical engineers.

The graduate student contribution to research in chemical engineering far outstrips that made to any other engineering field, a fact which provides insurance to the chemical industry.

Research accounts for almost 40 percent of the total college and university effort in chemical engineering. Slightly less than 14 percent of this total school effort is devoted to defense research. These figures to be compared with the national averages, for all the physical and engineering sciences are: 27 and 13 percent, respectively.

These substantial chemical engineering research undertakings are independent of educational institutions' work in chemistry; and in one sense the chemical engineers are backed up by the considerably larger research potential in chemistry. The survey showed 3,711 faculty members in college and university chemistry departments, of whom 3,319 are considered qualified to do research. Of these, 3,436 have projects underway, and their work is the equivalent of 1,316.1 full-time research scientists. Defense research accounts for 506.2 of these "equivalents."

Graduate students in chemical research number 6,949; their work is equivalent to that of a full-time staff of 3,468 junior research scientists.

NATIONAL DISTRIBUTION IS HEALTHY

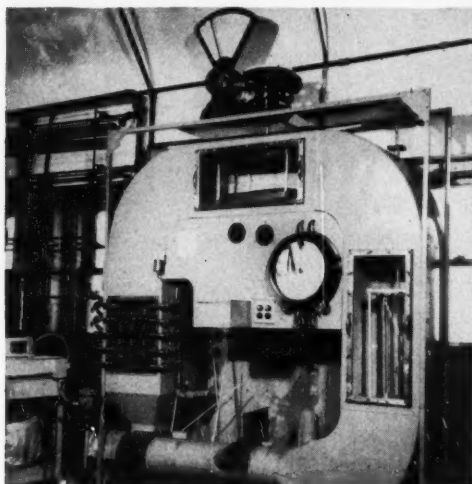
In general, chemical engineering research shows a broad and healthy national distribution. Schools in New England, the midwest, the southeast, the south, and the Pacific coast all appear near the top of the list.

There are variations, of course, in the amount of faculty time devoted to research; but in almost all cases these figures fall within reasonable limits. In larger departments (with exceptions noted below) research may take up to 60 percent of the total available faculty time. Among smaller schools this figure commonly ranges from 30 percent to 50 percent.

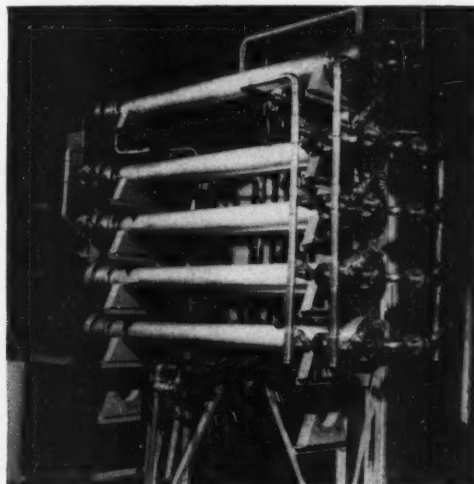
Defense projects, which account for just over one-third of all college and university chemical engineering research, show a very different distribution. Thirty-four schools have chemical engineering studies under military (including AEC) sponsorship. But 45 percent of this work is at four schools. (See preceding page.)

This "big four" group is the exception to the healthy distribution picture. These schools have only 93 qualified faculty members (13 percent of the national total); their research is equivalent to the work of 62 full-

Brooklyn Poly: Good example of facilities of the best schools



DRYER with automatic control of humidity and air temperature.



HEAT EXCHANGERS: A bank of 1-2 shell and tube exchangers.

time research workers (22 percent of the national total). At these schools, two-thirds of the faculty time is spent on research and nearly 75 percent of these studies are under military sponsorship.

ANY HOLES IN THE PATTERN?

There is now relatively little untapped chemical engineering research capacity in colleges and universities. Yet some increase is possible to help meet today's urgent needs for new knowledge.

Nationwide, 137 chemical engineering faculty members qualified for research now have no work underway. Thirteen schools have qualified chemical engineering departments in which no research is in progress.

Research in many smaller chemical engineering departments now involves less than one-third of the total faculty time. This may suggest some room for expansion, but no one can jump to that conclusion from these statistics alone. Research should probably be increased only in schools where resources are sufficient to assure that the new studies will not be at the expense of good teaching.

Finally, some of the many college and university chemists now without research may be able to turn their talents to the industrial problems ordinarily left to the chemical engineers.

WHERE IS THE PROFICIENCY?

College and university research interest covers the full breadth of the chemical engineering field. In connection with the Research Council's inventory, schools were asked to list the special fields of chemical engineering in which one or more staff members were interested and competent in research.

Here are the answers, showing the number of schools interested in each field.

PROCESSES AND OPERATIONS

Absorption and adsorption.....	80
Reactions and equilibria.....	16
Electrical separation.....	16
Extraction and solvent recovery..	76
Heat transmission.....	82
High pressure processes and catalysis.....	56
Mass transfer.....	73
Materials handling.....	20
Measurement and control of process variables.....	58
Mechanical separation.....	41
Phase-change separation.....	67
Pilot plant construction and operation.....	79
Sonic and ultrasonic vibrations...	21

INDUSTRIES

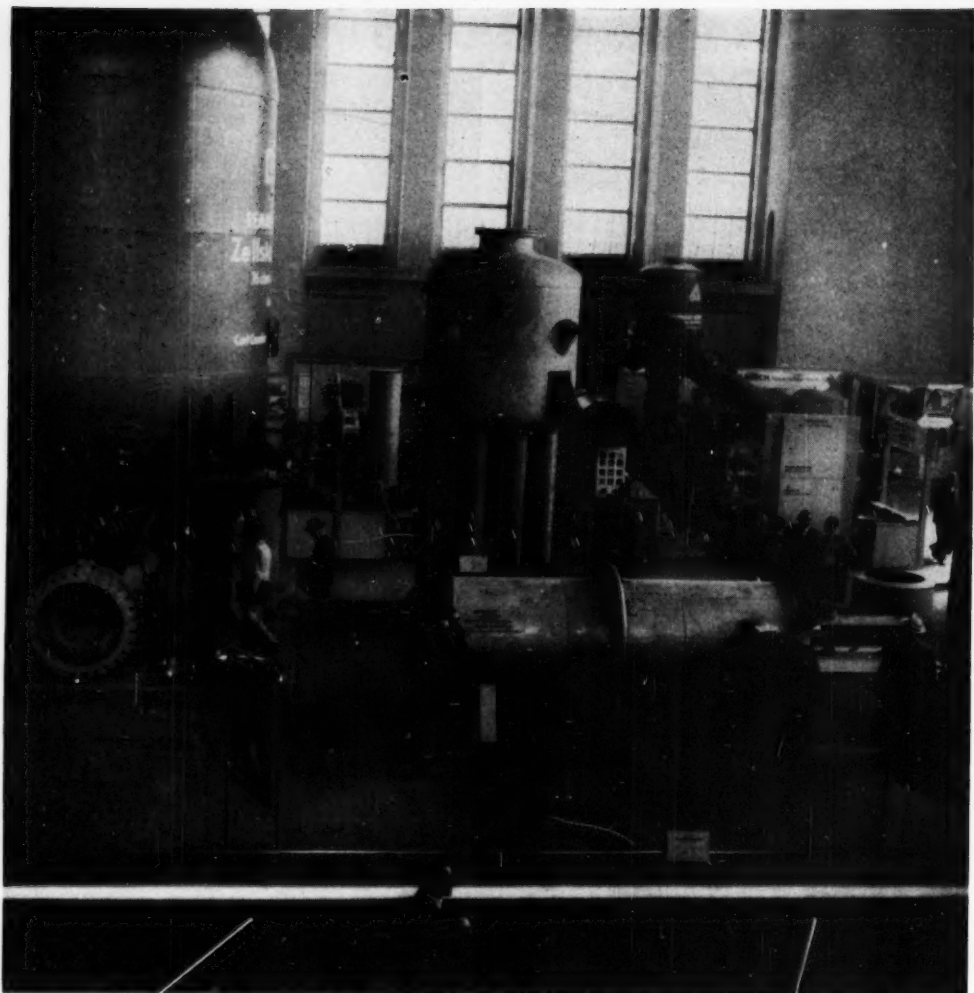
Agricultural chemistry.....	62
Alkalies.....	8
Cellulose and wood.....	38
Chemical warfare.....	45

Detergents and soap.....	43
Explosives.....	46
Fats, oils and waxes.....	54
Fermentation.....	31
Fertilizers.....	32
Forest products.....	18
Germicides, insecticides and fungus control.....	53
Heavy chemicals.....	13
Industrial wastes.....	92
Paints, varnishes, and color.....	38
Pharmaceutical chemistry.....	71
Photochemistry and chemistry of photography.....	47
Rubber and synthetic polymers..	54
Synthetic resins, fibers and plastics	60
Textiles.....	25
Water and sanitary chemistry....	64

This list obviously does not imply equal competence on the part of each educational institution listed. Potential sponsors and contractors still must pick their schools with care.* But the Council report does suggest that wide interests are represented, and that new research responsibilities can be accepted in some situations.

Few scientists—and chemical engineers least of all—will question the value of research opportunities.

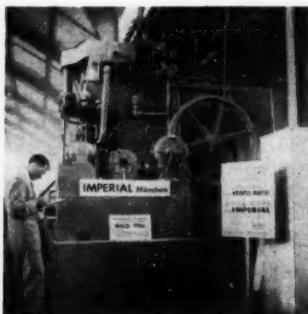
* The full report of the survey project, entitled "University Research Potential", identifies all schools reporting personnel, competencies, and special research equipment. Copies are available from the Secretary of the Engineering College Research Council at Room 7-204, 77 Massachusetts Avenue, Cambridge 39, Massachusetts, at \$1.00 each.



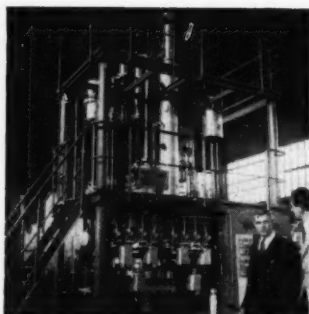
EQUIPMENT was largely conventional but impressive in size; here are a cellulose digester, heat exchanger and evaporator.



AGITATED vessel of stainless steel.



WALLQUIST filter for liquid wastes.



PILOT plant setup in operation.



EXHIBIT HALL had functional simplicity but plenty of life-size equipment.

ACHEMA-1952

Germany's process equipment manufacturers have just put on another of their famous exhibitions—ACHEMA X.*

As usual, they brought out their top-notch engineers, showed their biggest and best wares, chalked up plenty of sales from foreign countries.

This year's exhibition—probably the largest showing of chemical processing equipment ever seen anywhere—was held in combination with the 25th International Congress of Industrial Chemistry and with meetings of other organizations.

ACHEMA's exhibition occupied eight halls. Close to 575 manufacturers of chemical apparatus, machinery and equipment exhibited their latest products and developments.

* Biennial exhibition of the Dechema (Deutsche Gesellschaft für Chemisches Apparatewesen zur Förderung der Chemischen und Verbrauchsgüter-Technik) held at Frankfurt on May 13-25. Dr. Herbert Bretschneider is executive director of Dechema and organizer of AICHEMA X.

CE's observers summed up AICHEMA X like this:

► **Fast Come-Back**—Germany's chemical and processing equipment manufacturing industries are coming back—and coming back fast.

That's obvious, they say, from the exhibits. Although there was little equipment that could be considered as brand new or novel, there were definite signs of progress since the exhibition of 1950.

Solid progress, for example, showed up in many details of design, fabrication and materials of construction. This seems to be particularly true in the field of high-pressure equipment.

"Give them a few more years," one observer remarked, "and they'll be right back among the world's best, just as they were before World War II."

► **Slide Rule Business**—American firms will be interested to know that many AICHEMA exhibitors evidently did a



ENGINEERS—they came from all over the world—sit down to talk business.

land-slide business with foreign firms.

Our observers saw orders for equipment being written for Turkey, S. America, India, practically every industrialized nation in the world.

Guy Harcourt,* vice president of Buřlovak Equipment, put it something like this:

"People came to see the exhibits rather than a display of advertising art. They had their top-run engineers—not a bunch of bored-looking salesmen—sitting down with pencil and paper and slide rule, taking orders from all over the world."

It was obvious that AICHEMA exhibitors set up their wares to do business. And they did it.

In comparing AICHEMA with our own chem shows, Mr. Harcourt concludes with this pointed piece of advice: "Wake up, Americans!"

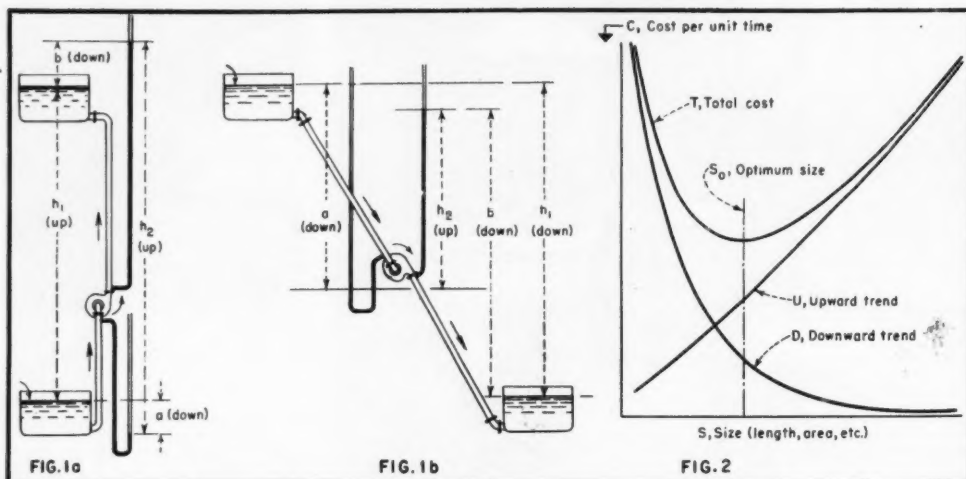
► **Other Features**—One of the features of the exhibits that struck all AICHEMA visitors was the size of the equipment. Much of it was full-scale plant units, and there seemed to be no limitations on size. Cranes were evidently available for moving heavy units.

Many of the large units—pilot plants, evaporators, filters, pumps—were in actual operation. Wherever possible, exhibitors showed their equipment in operation.

This emphasis on life-size equipment, often in actual operation, has long been a mark of AICHEMA.

One American observer was impressed by the opportunities for sociability: "Plenty of out-door lunch pavilions. . . where you could clinch a business deal—or just talk."

* Who took for CE the photographs you see on these pages.



Efficiency Doesn't Always Pay

The most efficient operation may not be the most economical.
You can't even calculate a realistic efficiency for some operations.
So forget efficiency and design for highest profit.

OLOF SCHWARTZKOPFF

In classical engineering "efficiency" is the guiding concept which influences design and measures performance. Power generating plants, for example, are designed and rated on the basis of their efficiency in converting fuel energy into electrical energy.

In process engineering the efficiency concept often has little practical significance. In very few cases are we concerned primarily with the conversion of energy with minimum loss. More often we are concerned with the design and operation of process plants at minimum cost.

NEGATIVE EFFICIENCIES

One big difficulty in the use of the efficiency concept for process engineering work is that many processes operate at a "negative efficiency". Here

DR. SCHWARTZKOPFF, consulting engineer, recently moved to this country from Germany, after 25 years with I. G. Farben and five more years doing consulting work in Europe. He makes his headquarters at 1617 Boulder St., Denver.

are two examples of negative efficiencies:

Downhill Pumping—According to the classical concept, efficiency of a pump may be defined on either a total or a dynamic basis:

$$\text{Total efficiency} = e_t = w h_{1c} / b \quad (1)$$

$$\text{Dynamic efficiency} = e_d = w h_2 / b \quad (2)$$

where w = mass flow rate, b = brake horsepower and c = an appropriate energy conversion factor. Terms h_1 and h_2 (see Fig. 1a) refer respectively to total static head and total dynamic head.

The two kinds of efficiency are interrelated by the hydraulic efficiency $e_h (= h_1/h_2)$ as follows:

$$e_t = e_d e_h \quad (3)$$

The hydraulic efficiency is an expression of the efficiency of the pipeline, for e_h refers to the total hydraulic path consisting of pump and pipeline, whereas e_d refers to the pump only.

Now consider the case where the discharge level of the conveyed fluid is below the fluid level at the entrance into the line (see Fig. 1b). The dynamic head of the pump h_2 , in this

case, supplements the gravity head h_1 , rather than overcomes it, as in the previous example. Hence the flow through the line is greater than it would be without a pump.

In process piping, provision of a pump may be the most economical arrangement when the point of discharge of a pipeline is below the entrance point but gravity head is insufficient to deliver the desired flow rate. In such cases the efficiency is negative, because numerator h_1 and denominator h_2 of the term h_1/h_2 have different signs.

Artificial Drying—In classical thermodynamics every natural process evolving by itself, such as drying, can generate power. Thermodynamically speaking, the maximum work represents 100 percent efficiency for the process.

To apply this theoretical concept, the irreversible elements must be eliminated from the process. In the case of drying, the irreversible diffusion of evaporated moisture into the air has to be replaced by some other arrangement which supplies mechan-

ical energy. The work could be done, for instance, by the evaporated moisture acting against semi-permeable walls which permit the passage of air but not of water vapor.

Hence every application of the simple natural drying process, such as drying lumber in forests or laundry in households, has an efficiency of zero—no work is gained in the process. Artificial drying, however, always has a negative efficiency—not only is there no work gained, but work and heat are added in industrial drying processes.

EFFICIENCIES VERSUS RATES

In both these examples of negative efficiency, there is a distinct contradiction between the classical treatment of energy and the reasoning used in actual engineering practice. The process engineer, being concerned primarily with getting results at lowest cost, finds it economical to speed up gravity fluid flow or natural drying, even at a loss in classical efficiency.

Suppose in the design of a heat exchanger we tried to arrive at the most "efficient" design. We cannot even establish a strict definition of efficiency of interchanging sensible heat if the efficiency is based on the mechanism of heat transfer only, since a completely reversible process ($\epsilon = 100$ percent) cannot occur in transferring sensible heat from one fluid to another having a different heat capacity.

As for the interchanging of latent heat in process engineering, Badger's opinion¹ as to the efficiency of evaporators may be quoted: "If efficiency be defined in the only way in which efficiency should be defined, namely, ratio of useful energy delivered to total energy input, then the efficiency of any evaporator is zero, because no evaporator delivers useful energy."

Many processes occurring in agitated vessels, such as dissolution of salt in water, are irreversible. In these cases the efficiency of the agitating equipment is negative, according to the classical definition.

The efficiency of every crusher or grinder must have a positive value, in view of the physical phenomenon of cohesion. Smekal² distinguishes between two processes of shredding: "The existence of physical shredding is assumed when surfaces of fracture are generated on a single body under the influence of an outside stress. Industrial shredding compiles the entire

mechanical work consumed by a shredding machine."

Smekal also gives the efficiencies: "The energetic efficiency of physical shreds is of the order of magnitude of 1 percent. The efficiency of industrial shredding, however, only has the order of magnitude of 0.1 percent."

We see, therefore, that primitive and slow natural processes have higher efficiencies than industrial processes. Industrial rates of speed are attained by the expenditure of relatively high amounts of energy. From the classical viewpoint, modern industrial processes are wasteful. Sound economic thinking, however, considers such expense as justified.

THE FOURTH DIMENSION

The classical scientist expresses his measurements in terms of length, mass and time. The process engineer adds a fourth dimension—money. He strives to get the optimum combination of all four dimensions.

Economics is not considered an exact science. In customary solutions of process engineering problems, therefore, economic factors are usually approximated or estimated.

Does process engineering suffer from the introduction of inexact economic factors? Judging from past experience, the answer is negative. Traditionally, questions in process engineering have been decided by some kind of economic calculation. Locally and chronologically correct economic data, and that method of calculation which most closely agrees with business reasoning, are recognized as necessary and sufficient prerequisites of useful results.

DETERMINING THE OPTIMUM

The basic approach to optimum economic design is shown in Fig. 2. Size S is plotted against cost C to get a curve T which passes through a minimum. Optimum size S_0 is that size which yields this minimum cost.

The method is simpler if you first plot two auxiliary curves. Curve U represents the cost factors which increase as size increases; curve D includes those factors which decrease as size increases. In most cases amortization, interest and maintenance will weigh heavily in curve U , while energy and possibly product losses will figure in curve D . For any particular

size, you merely add the values for U and D to get T .

A mathematical solution for the optimum size can be obtained by methods of simple differential calculus, remembering that the slope of curve T , dT/dS , will be zero at the minimum point.

Within the limits of accuracy of the data and for a limited range of S , we can replace curve U with a polygon of straight lines. A few lines of the polygon are sufficient for most cases. The equation for curve U then becomes that for a straight line:

$$U = AS \pm B \quad (4)$$

where A and B are constants.

Curve D can be expressed as

$$D = KP \quad (5)$$

where K is a measure of the quantity of energy, labor, etc., and P is the unit price of K . The value of K is a function of apparatus size S .

Totalling the cost, $T = U + D$, differentiating T with respect to S , and equating dT/dS to zero gives the general equation for optimum size:

$$-dK/dS = A/P \text{ for } S = S_0 \quad (6)$$

The optimum size S_0 of the apparatus occurs where the derivative $-dK/dS$ (physical or chemical process variables) balances the proportion A/P (economic constants). Note that constant B has been eliminated.

The simplicity of this approach makes it especially attractive where conditions change from one job to another.

PHYSICAL DATA STILL NEEDED

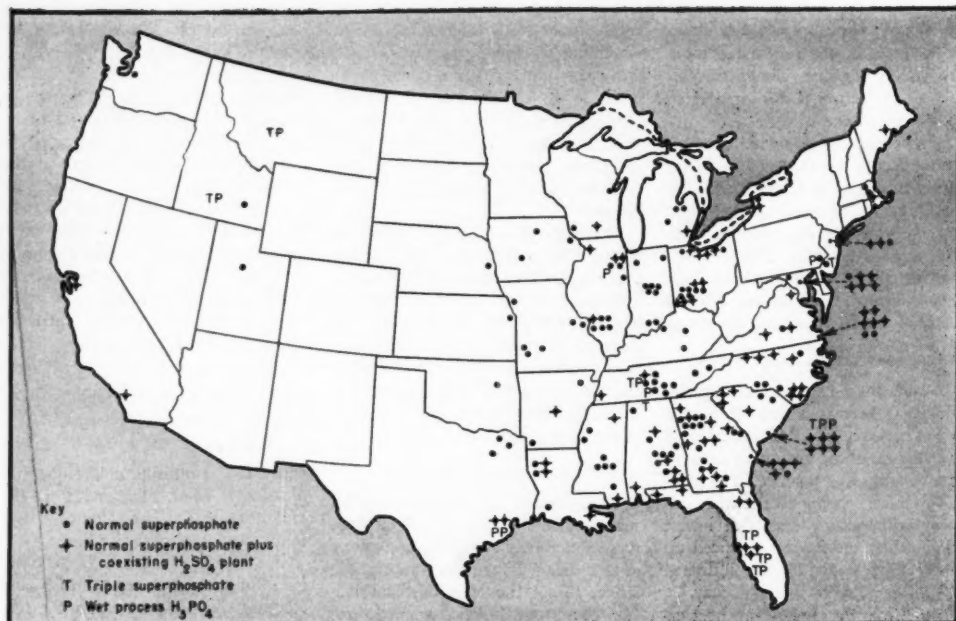
Does this emphasis on economics justify a slipshod fundamental scientific approach? Most certainly not. As the standing of economics in process engineering is raised, many new physical facts are needed.

The economic design of heat exchangers, for example, requires much more knowledge than is available today on thermal conductivities of surfaces fouled by corrosion and deposits.

Similar situations hold for most of the other problems which face the process engineer. Development of more adequate economic data and physical knowledge can both contribute to better process engineering.

REFERENCES

1. Badger, W. L., "Heat Transfer and Crystallization," Swenson Evaporator Co., Harvey, Ill., 1938.
2. Smekal, Adolph, VDI-Zeitschrift, Beih. Verfahrenstechnik, No. 4, Berlin, 1937.



WHERE the plants are situated; 202 make normal and 9, triplesuperphosphate; 13 make wet-process phosphoric acid.

New Data on Fertilizer Phosphates

WHO makes normal and triple superphosphate and wet-process phosphoric?

WHAT is the industry's capacity and production; where are its plants?

WHICH plants make sulphuric acid as well, and how much do they use?

This article is based on an extensive survey of the superphosphate and wet-process phosphoric acid industries during 1950 and 1951, conducted by the U. S. Department of Agriculture. Authors of the survey are J. R. Adams and K. D. Jacob, of the Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, Beltsville, Md., and T. H. Tremearne and L. G. Porter of the Office of Materials and Facilities, Production and Marketing Administration, Washington, D. C.—EDITOR.

Several recent developments, including the increasing demand for phosphate fertilizers, the shortage of sulphuric acid used in making over 90 percent of the country's P_2O_5 for fertilizer, and the AEC's interest in

Table IV—Sources of Sulphuric Acid for Normal Superphosphate Produced in 1950.

(Basis, 100 percent acid and equivalent 18 percent superphosphate)

Type of Acid, and Source	Acid Used		Normal Superphosphate Produced	
	Short Tons	Percent of Total	Short Tons	Percent of Total
Virgin acid				
Elemental sulphur.....	2,410,382	76.4	7,343,664	76.8
Pyrites and other iron sulphides.....	69,227	2.2	196,826	2.1
Fumes and gases from roasting and smelting non-ferrous metals.....	310,593	9.8	923,973	9.7
Unspecified sources.....	92,917	2.9	289,812	3.0
Total.....	2,883,119	91.3	8,754,275	91.6
Spent acid				
Manufacture of				
Alcohol.....	24,567	0.8	65,251	0.7
Detergents and dyestuffs.....	67,154	2.1	208,044	2.2
Explosives.....	39,820	1.3	122,750	1.3
Gasoline.....	27,403	0.9	83,268	0.9
Petroleum refining.....	13,942	0.4	33,398	0.3
Other sources ¹	33,003	1.0	97,958	1.0
Unspecified sources.....	67,487	2.2	191,954	2.0
Total.....	273,376	8.7	803,223	8.4
Grand total.....	3,156,495	100.0	9,557,498	100.0

¹ Metal refining, aniline industry, manufacture of insecticides, bromine and resin industry, drying of chlorine, and organic sulphonation.

Table I—Productive Capacity Compared with Production of Normal Superphosphate in United States for 1940, 1950 and First Half of 1951.

Region and State	Number of Plants	Annual Productive Capacity, ¹ Short Tons	Percent of Total Productive Capacity	Production		1950 Percent of 1940 to	1950 Total	Jan.-June 1951, ² Short Tons
				1940, Short Tons	1950, Short Tons			
New England.....	4	299,500	1.8	70,424	139,026	97.4	1.4	80,942
Middle Atlantic.....	14	1,941,234	11.7	1,204,194	1,881,005	48.8	19.7	1,046,402
N. Y., N. J., and Pa.....	7	734,000	4.4	341,164	545,932	60.0	5.7	275,977
Md.....	7	1,207,234	7.3	923,030	1,335,073	44.6	14.0	770,425
South Atlantic.....	71	5,610,038	33.9	1,308,330	2,991,547	128.6	31.3	1,688,541
Va.....	11	1,156,600	7.0	307,115	639,864	108.3	6.7	341,245
N. C.....	12	818,300	5.0	227,490	534,505	135.0	5.6	289,067
S. C.....	12	882,000	5.3	244,344	510,903	109.1	5.3	307,595
Ga.....	29	2,219,805	13.4	374,363	833,574	122.7	8.7	493,742
Fla.....	7	533,333	3.2	155,018	472,701	204.9	5.0	256,802
East North Central.....	45	3,854,823	23.8	617,099 ³	2,126,550	106.3	22.3	1,172,447
Ohio.....	17	1,241,531	7.5	352,899	728,029	106.3	7.6	379,820
Ind.....	9	753,646	4.6	88,053	411,434	367.2	4.3	205,045
Ill.....	12	1,245,000	7.5	176,147	682,710	287.6	7.2	410,476
Mich. and Wis.....	7	614,646	3.7	304,377	304,377	100.0	3.2	177,106
West North Central.....	11	637,200	3.9	319,057	319,057	100.0	3.3	189,596
Iowa, Nebr., and Kans.....	5	317,200	1.9	157,327	157,327	100.0	1.6	97,172
Mo.....	6	320,000	2.0	161,730	161,730	100.0	1.7	92,424
East South Central.....	37	2,322,950	14.1	538,726	1,192,090	121.3	12.5	583,629
Ky. and Tenn.....	14	989,950	6.0	235,507	593,779	132.4	6.2	248,758
Ala.....	14	793,000	4.8	207,408	379,970	83.2	4.0	218,272
Miss.....	9	540,000	3.3	75,811	218,281	187.9	2.3	116,599
West South Central.....	15	1,319,000	8.0	169,024	723,586	328.1	7.6	377,117
Ark. and Okla.....	4	383,500	2.3	61,046	232,166	601.6	2.4	141,796
La.....	6	531,000	3.2	107,978	295,266	173.4	3.1	146,602
Tex.....	5	404,500	2.5	196,154	196,154	100.0	2.1	88,719
Mountain and Pacific.....	5	553,000	3.3	57,429 ³	184,697	100.0	1.9	125,549
Continental U. S.....	202 ³	16,537,745	100.0	4,025,226	9,557,498	137.4	100.0	5,274,223

¹ Sept. 1, 1951, st. based on short tons of equivalent 18 percent superphosphate, assuming a work year of 300 two-shift days and adequate phosphate stock, sulphuric acid and storage facilities. ² Mch. included with Fla. and Pacific region. ³ Texas included with Ark. and Okla. ⁴ No production. ⁵ Data not comparable. ⁶ Production of 201 plants. ⁷ 193 of these plants used Florida rock. One Ohio plant (which also used Fla. rock) and three Tenn. plants (one also using Fla. rock) used Tenn. rock. Five plants in the Mtn. and Pacific region used western rock only, the only plants using western rock.

Table II—Grades of Normal Superphosphate Produced in 1950.

Available P ₂ O ₅ Range, Percent	Number of Plants	Production, Equiv. 18% Material, Short Tons	Percent of Total
<18.25.....	28	1,367,943	14.3
18.25-18.99.....	6	232,512	2.4
19.00-19.24.....	16	444,923	4.6
19.25-19.49.....	26	725,422	7.6
19.50-19.74.....	63	2,471,564	25.8
19.75-19.99.....	15	477,695	5.0
20.00.....	38	3,493,350	36.6
>20.00.....	9	279,512	3.0
Total.....	221 ¹	9,492,921	99.3
Wet-base goods, 8.00-18.00.....	7 ²	64,577	0.7
Grand total.....	227	9,557,498	100.0

¹ Some plants make more than one grade. ² Also make normal superphosphate.

phosphate rock as a source of uranium, combine to make up-to-date informa-

Table V—Where Acid Made in Coexisting Sulphuric Acid Plants Went in 1950.

(Basis, short tons 100 percent H₂SO₄ made at normal superphosphate plants)

	Used in Coexisting Sulphuric Acid Plants	Used in Other Company-Owned Plants	Sold to Other Fert. Mfrs.	Sold to Non-Fert. Mfrs.	Total Produced
New England.....	435,078	94,580	141,322	460,699	1,101,688
Middle Atlantic.....	813,357	270,010	37,343	31,550	1,152,260
East North Central.....	257,472	4,980	38,536	59,979	360,967
West North Central.....	0	0	0	0	0
East South Central.....	129,345	6,736	6,225	10,167	152,473
West South Central.....	112,079	166,037	15,431	29,885	323,432
Mountain and Pacific.....	1	1	1	1	1
Continental U. S.....	1,762,075 ¹	547,235 ²	249,136 ³	700,869 ⁴	3,259,315 ⁵
Percent of total.....	54.1	16.8	7.6	21.5	100.0

¹ Included in Continental United States. ² Includes tonnages for New England and Mountain and Pacific regions.

tion necessary on the superphosphate and wet-process phosphoric acid industries. The last similar, but more limited, survey was in 1941. The present survey, made with the cooperation of

the entire industry, uncovered a vast amount of information on both normal and triple superphosphate, on wet-base goods and on non-electric-furnace phosphoric. It located the

Table III—Sulphuric Acid (Basis 100 Percent) Used in 1950 for Normal Superphosphate Production.

Region	Number of Plants		Source of Acid									
			Coexisting Acid Plant		Other Company-Owned Plant		Other Fertilizer Manufacturer		Non-Fertilizer Manufacturer		Total Acid	
	Quantity, Short Tons	Percent of Total	Quantity, Short Tons	Percent of Total	Quantity, Short Tons	Percent of Total	Quantity, Short Tons	Percent of Total	Quantity	Percent of Total		
New England.....	A ¹	B ²					9,649	0.3	5,720	0.2		
Middle Atlantic.....	2	6	405,078	12.8		0.1	30,533	1.0	165,038	5.2	601,229	<19.1
South Atlantic.....	48	25	813,357	25.8	9,389	0.3	86,221	2.7	79,810	2.5	988,777	31.3
E. No. Central.....	15	30	257,472	8.2	49,503	1.5	62,638	2.0	362,377	11.5	731,990	23.2
W. No. Central.....	0	11							98,375	3.1	98,375	3.1
E. So. Central.....	10	27	129,345	4.1	6,750	0.2	45,875	1.4	208,438	6.6	390,408	12.3
W. So. Central.....	6	9	112,079	3.6			5,703	0.2	112,742	3.6	230,524	7.4
Mtn. and Pacific.....	2	3	1		6,029	0.2			49,050	1.6	1	
Total.....	91	113	1,762,075 ³	55.8 ³	72,251	<2.3	240,619	7.6	1,081,550	34.3	3,156,495 ⁴	100.0 ⁵

¹ Plants having coexisting sulfuric acid plants. ² Plants not having coexisting sulfuric acid plants. ³ Included in total. ⁴ Includes tonnages for New England and Mountain and Pacific regions. ⁵ Includes percentages for New England and Mountain and Pacific regions.

Table VI—Triple Superphosphate Industry in 1950, 1951.

Triple super produced, eq. 45% P ₂ O ₅ , short tons	
Jan.-June '50	319,184
July-Dec. '50	340,950
1950 total	660,134
Jan.-June '51	357,738
Triple super capacity, Sept. 1, 1951 (based on 45% equivalent P ₂ O ₅ , 350-day operation and no shortages or storage problems), 793,018 short tons annually.	
Number of plants, 9: ¹	
Tons of rock acidulated with phosphoric acid, 1950	
From Florida	225,993
From Tenn. and West	48,129
Total	274,122
Phosphoric acid used, short tons eq. 50% H ₃ PO ₄ , 1950	
Wet process	490,952
El. furnace	126,519 ²
Total	617,471

¹ Three plants in Fla., one each in N. J., S. C., Tenn., Ala., Idaho, Mont. ² Includes a small quantity of spent furnace acid.

Table VII—Wet-Process Phosphoric Industry in 1950.

Eq. 50% H ₃ PO ₄ produced, short tons	679,215
Average grade of acid, % H ₃ PO ₄	
As produced	33.2
After concentration	63.3 ¹
Quantity sold (eq. 50%)	
For fertilizer use	13,298
For other use	11,070
Total sold	24,368
Wet-process acid capacity, Sept. 1, 1951 (based on eq. 50% H ₃ PO ₄ assuming 350-day operation and no shortages), 1,282,104 short tons annually.	
Number of plants, 13:	
Tons of phosphate rock used	
From Florida	885,424
From Tenn. and West	177,506
Total	1,062,930
Sulphuric acid used, short tons, basis 100% H ₂ SO ₄	
Type of plant	
Coexisting acid plant	720,809
Fertilizer mfrs.	92,438 ²
Non-fertilizer mfrs.	46,533
Total	859,780
Form of sulphur	
Elemental	668,864
Other	190,916 ³
Total	859,780

¹ Four plants did not concentrate and their acid is not included in total. ² Two of these are company-owned plants, two of other fertilizer mfrs. ³ Includes iron sulphides, sour gas, fumes and gases from smelters, and unspecified; also a small quantity of spent acid.

202 plants of the 85 normal superphosphate makers in continental United States, and the additional two plants in Hawaii and in Puerto Rico; also the 9 plants operated by 8 makers of triple superphosphate and the 13 plants of 11 producers of wet-process phosphoric acid. It found which plants also make sulphuric acid, and how much; where the acid came from and where it went; what the output of phosphate products is, and what the capacity could be, assuming no shortages.

Where are the plants? The map on page 142 shows all that were operating on Sept. 1, 1951. It spots the 91 plants which had coexisting sulphuric plants, as well as the triple super and wet-process phosphoric plants. A reported six normal super-

Table VIII—Companies Making Normal Superphosphate in U.S. as of Sept. 1, 1951.

(Asterisk * on plant location indicates coexisting sulphuric acid plant.)

Company ¹ Name and Address of Main Office	Number of Plants	Location of Plants ²
Acme Fertilizer Co., Wilmington, N. C.	1	Acme, N. C.*
Adair & McCarty Bros., Inc., A. D., Atlanta, Ga.	2	East Point, Ga.; Chattanooga, Tenn.
Alabama Warehouse Co., Troy, Ala.	1	Troy, Ala.
American Agricultural Chemical Co., The, New York, N. Y.	17	Montgomery, Ala.*; Pensacola,* Pierce,* Fla.; Savannah, Ga.*; East St. Louis,* Fulton,* Ill.; Baltimore, Md.*; North Weymouth, Mass.*; Detroit, Mich.*; Carteret, N. J.*; Buffalo, N. Y.*; Charleston, S. C.*; Greensboro, N. C.*; Cincinnati,* Cleveland,* Ohio; Columbia, S. C.*; Alexandria, Va.*
Anderson Fertilizer Co., Inc., Anderson, S. C.	1	Anderson, S. C.*
Ark Mo Plant Food Co., Inc., Walnut Ridge, Ark.	1	Walport, Ark.
Armour Fertilizer Works, Atlanta, Ga.	15	Jacksonville, Fla.*; Albany,* Atlanta,* Columbus,* Ga.; Chicago Heights,* East St. Louis, Ill.; New Orleans, La.*; Carteret, N. J.*; Greensboro,* Navesa,* N. C.; Cincinnati, Sandusky,* Ohio; Nashville, Tenn.*; Dallas, Houston,* Tex.
Baugh Chemical Co., The,* Baltimore, Md.	2	Baltimore, Md.*; Philadelphia, Pa.
Buhner Fertilizer Co., The, Danville, Ill.	1	Danville, Ill.
Catawba Fertilizer Co., Lancaster, S. C.	1	Lancaster, S. C.
Central Chemical Corp., Hagerstown, Md.	1	Hagerstown, Md.
Consolidated Rendering Co., Boston, Mass.	1	Lowell, Mass.
Consumers Cooperative Association, Kansas City, Mo.	1	South St. Joseph, Mo.
Consumers Cooperatives Associated, Red Star Fertilizer Division, Sulphur Springs, Tex.	1	Sulphur Springs, Tex.
Contentnea Guano Co., Wilson, N. C.	1	Wilson, N. C.
Cooperative Fertilizer Service, Inc., Richmond, Va.	1	Winchester, Ky.
Cooperative Plant Foods, Inc., Schererville, Ind.	1	Schererville, Ind.
Cotton Producers Association, The, Atlanta, Ga.	2	Carrollton, Cordele, Ga.
Cotton States Fertilizer Co., Macon, Ga.	1	Macon, Ga.*
Darling and Co., Chicago, Ill.	1	East St. Louis, Ill.
Davison Chemical Corp., The, Baltimore, Md.	4	Perry, Iowa; Baltimore, Md.*; Columbus, Ohio; Nashville, Tenn.
Diamond Fertilizer Co., The,* Sandusky, Ohio	2	Lansing, Mich.; Sandusky, Ohio.*
Dixie Guano Co., Laurinburg, N. C.	1	Laurinburg, N. C.
Etheredge Guano Co., Augusta, Ga.	1	Augusta, Ga.
Farm Belt Fertilizer and Chemical Co., Kansas City, Mo.	1	Kansas City, Kans.
Farm Bureau Cooperative Association, Inc., The, Columbus, Ohio.	1	Dayton, Ohio.
Farm Bureau Services, Inc., Lansing, Mich.	1	Saginaw, Mich.
Farmers Cotton Oil Co., Wilson, N. C.	1	Norfolk, Va.
Farmers Fertilizer Co., The, Columbus, Ohio	1	Columbus, Ohio.*
Farm Fertilizers, Inc., South Omaha, Nebr.	1	South Omaha, Nebr.
Federal Chemical Co., Louisville, Ky.	2	Columbus, Ohio; Nashville, Tenn.
Fertilizer Manufacturing Cooperative, Inc., Baltimore, Md.	1	Baltimore, Md.
Forkin Phosphate Co., Green Bay, Wis.	1	Green Bay, Wis.
Georgia Fertilizer Co., Valdosta, Ga.	1	Valdosta, Ga.*
Gulport Fertilizer Co., Gulport, Miss.	1	Gulport, Miss.*
Hamm Co., The M., Washington C. H., Ohio	1	Washington C. H., Ohio.
Hi-Yield Fertilizer Co., Bonham, Tex.	1	Bonham, Tex.
Hodgson's Inc., Athens, Ga.	1	Athens, Ga.*
Home Guano Co., The, Dothan, Ala.	1	Dothan, Ala.*
Illinois Farm Supply Co., Chicago, Ill.	1	E. St. Louis, Ill.
Indiana Farm Bureau Cooperative Association, Inc., Indianapolis, Ind.	2	Indianapolis, New Albany, Ind.
International Minerals and Chemical Corp., Chicago, Ill. ³	17	Florence, Montgomery, Ala.; Texarkana, Ark.; Amerious, Augusta, East Point, Tifton, Ga.; Chicago Heights, Ill.; Mason City, Iowa; Woburn, Mass.; Tupelo, Miss.*; Buffalo, N. Y.; Lockland, Ohio;* Hartsville, Spartanburg, S. C.*; Greenville, Wales, Tenn.
Jackson Fertilizer Co., Jackson, Miss.	1	Jackson, Miss.
Kelly, Weber and Co., Inc., Lake Charles, La.	1	Lake Charles, La.
Kingsbury and Co., Indianapolis, Ind.	1	Indianapolis, Ind.
Knoxville Fertilizer Co., Knoxville, Tenn.	3	London, Ky.; Knoxville,* Nashville, Tenn.
Lange Brothers, Inc., St. Louis, Mo.	1	St. Louis, Mo.
Mathieson Chemical Corp., Baltimore, Md.	3	Little Rock, Ark.*; Baltimore, Md.*; Houston, Tex.*
Meridian Fertilizer Factory, Hattiesburg, Miss.	1	Hattiesburg, Miss.
Mineral Fertilizer Co., Inc., Midvale, Utah	1	Midvale, Utah.
Mississippi Federated Cooperatives (AAL), Jackson, Miss.	1	Canton, Miss.
Mississippi Valley Superphosphate Co., Greenville, Miss.	1	Greenville, Miss.

phosphate plants more recently installed are not shown. Tables VIII, IX and X name the companies, give locations of both the home offices and the plants.

What is the capacity and the output? Table I summarizes the picture

for normal superphosphate, showing estimated capacity of 16,537,745 short tons of equivalent 18 percent P₂O₅ superphosphate, with nearly 85 percent east of the Mississippi. Nearly three-quarters of the capacity is controlled by companies operating two

Table VIII—Normal Superphosphate Plants, Cont.

(Asterisk * on plant location indicates coexisting sulphuric acid plant.)

Company ¹ Name and Address of Main Office	Number of Plants	Location of Plants ²
Missouri Farmers Association, Inc., Columbia, Mo.	2	Maryland Heights, Springfield, Mo.
Mutual Fertilizer Co., Savannah, Ga.	1	Savannah, Ga.
Naco Fertilizer Co., New York, N. Y.	1	Charleston, S. C.*
North American Phosphate Co., Louisville, Ky.	1	Louisville, Ky.
Pelham Phosphate Co., Pelham, Ga.	1	Pelham, Ga.*
Planters Fertilizer and Phosphate Co., Charleston, S. C.	1	Charleston, S. C.*
Pringle and Co., Inc., A. F., Charleston, S. C.	1	Charleston, S. C.*
Rauh and Sons Fertilizer Co., E., Indianapolis, Ind.	2	Indianapolis, Ind.; Sylvania, Ohio.
Richmond Guano Co., Richmond, Va.	1	Richmond, Va.
Roanoke Guano Co., Roanoke, Ala.	1	Roanoke, Ala.
Robertson Chemical Corp., Norfolk, Va.	1	Norfolk, Va.*
Royster Guano Co., F. S., Norfolk, Va.	11	Bessemer, Montgomery, Ala.; Macon, Ga.*; Indianapolis, Ind.; Baltimore, Md.*; Jackson, Miss.; Charlotte, N. C.; Toledo, Ohio.*; Charleston, S. C.*; Norfolk, Va.*; Madison, Wis.*
Shreveport Fertilizer Works, Shreveport, La.	1	Shreveport, La.
Simplot Fertilizer Co., Pocatello, Idaho.	1	Pocatello, Idaho.
Smith Agricultural Chemical Co., Columbus, Ohio.	3	Indianapolis, Ind.; Saginaw, Mich.; Columbus, Ohio.*
Smith-Douglas Co., Inc., Norfolk, Va.	2	Streator, Ill.; Norfolk, Va.*
Smith Guano Co., C. O., Moultrie, Ga.	1	Moultrie, Ga.*
Southern Agricultural Fertilizer Co., Clarkdale, Miss.	1	Clarksdale, Miss.
Southern Fertilizer and Chemical Co., Savannah, Ga.	2	Atlanta, Savannah, Ga.*
Southern States Phosphate and Fertilizer Co., Savannah, Ga.	1	Savannah, Ga.*
Standard Chemical Co., Troy, Ala.	1	Troy, Ala.*
Stauffer Chemical Co., San Francisco, Calif.	3	Stege,* Vernon,* Calif.; Tacoma, Wash.
Summers Fertilizer Co., Baltimore, Md.	1	Seasport, Maine.*
Swift and Co., Chicago, Ill.	10	Albany, Atlanta, LaGrange, Ga.; National Stock Yards, Calumet City, Ill.*; Harvey,* Shreveport, La.; Wilmington, N. C.*; Cleveland, Ohio; Norfolk, Va.*
Tennessee Corp., ³ New York, N. Y.	5	Montgomery, Ala.; East Tampa, Fla.*; East Point, Ga.; New Albany, Ind.; Lockland, Ohio.
Tennessee Farmers Cooperative, Nashville, Tenn.	1	LaVergne, Tenn.
Thomas and Son Co., I. P., Camden, N. J.	1	Paulboro, N. J.
Thurston Chemical Co., Joplin, Mo.	2	Joplin, Mo.; Tulsa, Okla.
Tri-State Chemical Co., Webb City, Mo.	1	Webb City, Mo.
Virginia-Carolina Chemical Corp., ⁴ Richmond, Va.	26	Birmingham,* Dothan,* Mobile,* Montgomery, Ala.; Nicholls, Fla.*; Augusta,* Rome,* Savannah,* Ga.; East St. Louis, Ill.; Fort Wayne, Ind.; Dubuque, Iowa; Shreveport, La.*; Jackson, Miss.; Carteret, N. J.; Charlotte, Durham,* Selma,* Wilmington,* N. C.; Cincinnati, Ohio.*; Charleston,* Greenville,* S. C.; Memphis,* Mt. Pleasant, Tenn.; Lynchburg,* Portsmouth,* Richmond,* Va.
Weaver Fertilizer Co., Norfolk, Va.	1	Norfolk, Va.
Wilson and Toomer Fertilizer Co., ⁵ Jacksonville, Fla.	2	Cottontale,* Jacksonville,* Fla.
Wisconsin Cooperative Farm Plant Foods, Madison, Wis.	1	Prairie du Chien, Wis.
Territories		
Ochoa Fertilizer Corp., Hato Rey, Puerto Rico.	1	Hato Rey, Puerto Rico.*
Pacific Chemical and Fertilizer Co., Honolulu, Hawaii.	1	Honolulu, Hawaii.*

¹ Companies operating under different names but having the same officials and companies known to be subsidiaries of, or controlled by, another company are included as one company. ² East Point, Ga., plant is operated as Furman Fertilizer Works and the Chattanooga, Tenn., plant as Chickamauga Fertilizer Works. ³ Baltimore, Md., plant is operated as The Baugh Chemical Co. and the Philadelphia, Pa., plant as Baugh and Sons Co. ⁴ Normal superphosphate facilities were being rebuilt at the time of this survey. ⁵ Lansing, Mich., plant is operated as The Michigan Fertilizer Co. and the Sandusky, Ohio, plant as The Diamond Fertilizer Co. The two plants are affiliated. ⁶ The fertilizer plant operates under the name Empire State Chemical Co. ⁷ Columbus, Ga., plant discontinued production in 1951. ⁸ The plant at East Tampa, Fla., operates as U. S. Phosphoric Products Division, Tennessee Corp., and the Montgomery, Ala., plant is a subsidiary operating as Capital Fertilizer Co. ⁹ Wadeboro, N. C., plant discontinued operation in 1951. ¹⁰ Cottontale, Fla., plant operated as Carledge Fertilizer Co. ¹¹ Plants for normal superphosphate on which no data are available, and which are not included in Table VIII or on the map, were reported recently completed or under construction on Sept. 1, 1951, at Mt. Pleasant, Tenn., Bartlesville, Okla., Wilmington, N. C., and Ft. Worth, Tex.

or more plants. Production on the equivalent basis was 9,557,498 tons in 1950, but rose to 5,274,223 tons for the first half of 1951—winding up at around 11,000,000 tons for all of 1951. Although combined for statistical purposes as 18 percent equiv-

alent, normal superphosphate is actually made in some 35 grades, grouped in ranges as in Table II. There are also some eight grades of wet-base goods, made by the acidulation of mixtures of phosphate rock with organic materials.

Table IX—Companies Making Triple Superphosphate in U. S. as of Sept. 1, 1951.

Anaconda Copper Mining Co., New York, N. Y.; plant at Anaconda, Mont.
Armour Fertilizer Works, Atlanta, Ga.; plants at Bartow, Fla., and Siglo (Columbia), Tenn.
Gates Bros., Inc., Wendell, Idaho; plant at Wendell, Idaho.
Swift and Co., Chicago, Ill.; plant at Agricola, Fla.
Tennessee Corp., New York, N. Y.; plant at East Tampa, Fla., operated as U. S. Phosphoric Products Div. of Tennessee Corp.
Tennessee Valley Authority, Wilson Dam, Ala.; plant at Wilson Dam, Ala.
I. P. Thomas and Son Co., Camden, N. J.; plant at Paulsboro, N. J.
Virginia-Carolina Chemical Corp., Richmond, Va.; plant at Charleston, S. C.

Table X—Companies Making Wet-Process Phosphoric Acid in U. S. as of Sept. 1, 1952.

Anaconda Copper Mining Co., New York, N. Y.; plant at Anaconda, Mont.
Armour Fertilizer Works, Atlanta, Ga.; plants at Bartow, Fla., and Siglo (Columbia), Tenn.
Blockson Chemical Co., Joliet, Ill.; plant at Joliet, Ill.
Gates Bros., Inc., Wendell, Idaho; plant at Wendell, Idaho.
General Chemical Div., Allied Chemical and Dye Corp., New York, N. Y.; plant at Marcus Hook, Pa.
Gulf Chemical Co., Inc., Houston, Tex.; plant at Houston, Tex.
International Minerals and Chemical Corp., Chicago, Ill.; plant at Wales, Tenn.
Mathieson Chemical Corp., Baltimore, Md.; plant at Houston, Tex.
Swift and Co., Chicago, Ill.; plant at Agricola, Fla.
Tennessee Corp., New York, N. Y.; plant at East Tampa, Fla., operated as U. S. Phosphoric Products Div. of Tennessee Corp.
Virginia-Carolina Chemical Corp., Richmond, Va.; two plants at Charleston, S. C.

What about the acid situation in this largest of sulphuric acid consuming industries? Tables III, IV and V summarize the picture. Table III shows the acid used, and where secured, Table IV its sources, and Table V, where the acid so made finally went. Over 21 percent, it is interesting to note, was sold to non-fertilizer manufacturers.

Tables VI and VII are useful for their disclosure of the capacity, size and production of the triple super and wet-process phosphoric acid industries.

Over 96 percent of the phosphate rock used in normal superphosphate manufacture came from Florida, with corresponding figures of 82 and 83 percent for triple super and wet-process phosphoric, respectively.

Some 22 of the plants are equipped for fluorine recovery, although not all are used. In 1951 there was fluorine products production of approximately 27,000 tons from 16 of these plants, over half as sodium fluosilicate.



Acres of De Nora Chlorine Cells . . .

Some two acres of them, in fact. All turning out chlorine at the new \$15 million caustic-chlorine plant of Army Chemical Corps at Muscle Shoals, Ala.

The new unit—the first large installation of De Nora mercury cells in the U.S.—has just gone on stream. It will be able to turn out an estimated 150 tons of chlorine daily for chemical defense needs.

Monsanto Chemical designed the plant, Leonard Construction Co. of Chicago built it. Monsanto will oper-

ate it for the government. In full operation, the semi-automatic plant will employ about 150 people.

Heart of the plant is the huge, 2.25-acre room in which banks of 30,000-amp. De Nora cells convert purified brine into chlorine, caustic soda and hydrogen.

Each cell at Muscle Shoals can turn out daily 1.0 ton of 97-98 percent chlorine gas, 1.7 tons of 70 percent caustic soda and 10,000 cu. ft. of 99.8-99.9 percent hydrogen (20 deg. C.).

To do this, each cell requires 1.75 tons of salt, some 3,100 kwh. of electric power and 3,500 lb. of recycle mercury. Muscle Shoals' investment in mercury hits close to \$3 million.

The chlorine (in which the Chemical Corps is primarily interested) is collected, cooled, dried and liquefied by compressing it at a temperature of about -40 deg. F. The plant uses about 10,000 gal. of cooling water per minute.

Chemical Corps will use part of the caustic soda, sell the bulk of it. The



high-purity hydrogen is fed as fuel to the plant's steam boilers, thus reduces the consumption of natural gas.

The De Nora-type mercury cells used at Muscle Shoals were developed by Impianti Elettrochimici di Milan, the firm of Dr. Oronzio De Nora. The first unit to use these cells was built in Italy in 1936, but the Muscle Shoals plant is the first large-scale installation of De Nora cells in this country (Monsanto and Marathon Paper Mills of Canada have both recently put in 25-ton-per-day units). Monsanto now has an agreement for the use and sale of the De Nora amalgam cell in the U.S. and some other countries.

The cell itself is a long, narrow steel trough lined with a chemically resistant stone. Suspended in the trough are blocks of dense graphite which serve as anodes. They are supported by hard rubber covers which seal the top of the trough and make it gas tight.

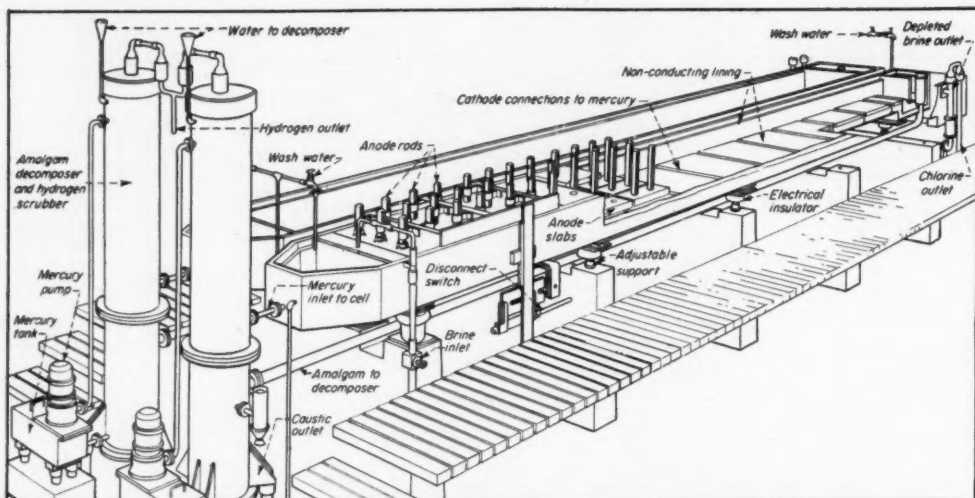
Anode life in a 30,000-amp, 4.3-v. cell is about 10 months; in a 15,000-amp., 4.1-v. cell it's 14 months.

A thin film of mercury flows by gravity along the bottom of the trough as the cathode. Only about 0.2 in. separates the graphite anodes from the mercury cathode. Consumption of graphite electrodes is about 7 lb. per ton of chlorine.

Brine flows on top of the mercury and is decomposed by the electric current passing between the mercury and the graphite electrodes. Chlorine is released as 97-98 percent gas, while the sodium dissolves in the mercury to form mercury amalgam. The normal amalgam concentration is 0.05-0.15 percent sodium.

Current efficiency in the cell is 94-96 percent. Operating temperature should normally be 65-70 deg. C. It can operate from 40 percent up to 120 percent of rated capacity.

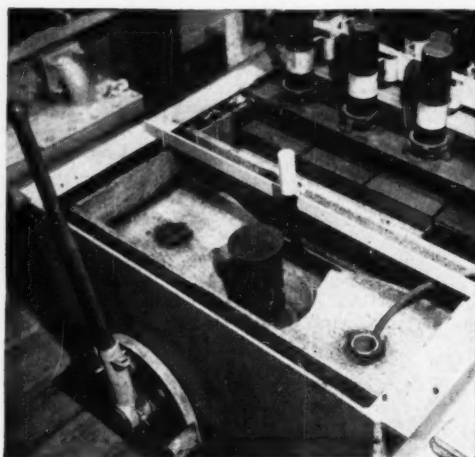
A 30,000-amp. cell to turn out 1.0 ton of chlorine per day is 60 ft. long and 5.5 ft. wide, including aisles. Thus each cell at Muscle Shoals re-



DE NORA CELLS . . .



CAUSTIC end with amalgam decomposers.



CHLORINE end with anode rods and slabs.

quires a total floor space of about 330 sq. ft.

Amalgam from the cell flows into a small steel tower packed with lumps of graphite. Water is fed into the tower, reacts with the sodium to form caustic soda and hydrogen. The mercury returns to the cell for reuse. Although each 30,000-amp. cell requires 3,500 lb. of mercury, the actual mercury consumption is only 0.25 lb. per ton of chlorine.

Caustic is made in this compact vertical two-stage decomposer. Here the amalgam is completely decomposed, and rayon-grade caustic soda up

to 73 percent concentration is turned out. The decomposer rarely needs cleaning or graphite replacement.

Unless caustic of maximum purity is made, ordinary water can be fed into the decomposer. It should be steam-jacketed if 70 percent caustic is produced.

Sides and bottom of the De Nora cell are normally lined with syenite—a natural material almost permanently resistant to corrosion from brine, chlorine and mercury amalgam. Drained cells, because of this bottom lining, don't have to be washed with hot water and dilute caustic as do

other types of mercury cells with exposed steel bottoms.

This lining—besides having a relatively low first cost—can easily be repaired or replaced in the field. It also acts as an insulator so that the cell is not susceptible to changes in outside temperature. Even if the flow of mercury should stop, the syenite lining above the steel bottom practically does away with the danger of explosion from evolution of hydrogen.

The Muscle Shoals project was built under a cost-plus-fixed-fee contract—at a cost that was close to 7 percent under the estimate.

Editorial Viewpoints

Security Can Be a Snare

We've been talking to a lot of people recently about job opportunities. Especially graduates just getting their degrees or young engineers, usually still in their twenties, who think they'd like to make a move.

Some of these young engineers want to try their talents in a different industry or a different type of job or a different area of the country. Some of them—not so few, either—come to us because they'd like to tackle our own particular brand of chemical engineering: editorial work.

These reasons are all perfectly understandable. And it's understandable, too, why most of them put high stock in a bigger pay check. That's human nature, and no sin.

But what we don't understand is why some of them seem to put so much emphasis on security and "fringe benefits."

A proper regard for security is a mark of intelligence. But it's a pitiful sight to see a man start out in life all concerned about severance allowances, sick leave, vacations with pay—even retirement benefits! Any virile young man is contemptuous of such pamperings, seeks out challenges and opportunities instead.

This premature preoccupation with security may be a sign of our times, an attitude fostered by the growing paternalism of government and industry. And we suspect that too many companies now stoop to dangle such trivia as bait in the hopes of getting their quota of hard-to-get men.

It all reminds us of a lovable old man we once knew whose living philosophy was this: "God didn't create man to be coddled, and Nature abhors security."

Or to put it in the words of a well-known engineer we talked to the other day: "The only man worth hiring is the man looking for opportunities; the only company worth working for is the company offering opportunities."

Now the Tank's a Part of the Car

There's good news for chemical users of private tank cars: they'll now get a boost in railroad mileage allowance from 2.2 c. to 3 c. per mile. The increase became effective July 1.

Thus the railroads now recognize that mileage allowance should not be limited to the running gear alone, admit for the first time that the tank itself is a part of the car!

The increase applies to some 30,000 private tank cars now in chemical service and more than 80,000 cars

carrying petroleum products. Hopper cars will also get an increase from 2.25 c. to 3.2 c.

It's all the result of work by the Manufacturing Chemists Association, American Petroleum Institute and companies leasing tank cars. These got together more than a year ago and filed an application with the railroads for the increase.

For the chemical industry alone, annual savings will tot up to some \$3 million, says J. W. Brown, who has headed up MCA's tank car advisory subcommittee.

Yankee Stadium Fifty Times

"One of the noblest purposes of mankind is the saving of human life." So spoke the President a while ago.

Yet last year, in the workplaces of the nation, we lost the lives of 16,000 fellow men, most of them husbands and fathers. Multiply that figure by two or three and you have an index of the broken homes, hearts and lives.

Why did it have to happen? Somebody at the bottom was careless, somebody at the top was complacent, somebody in the middle lacked the courage to pound his fist on the table in the front office and on the bench in the locker room and say "We're gonna make this the safest danged plant in the country if I have to lick every man in the organization to do it."

Last year we had about two million workers disabled in American industry—Yankee Stadium full to the seams fifty times over with broken limbs, gutted eyes, bloody stumps. In 1951, we had four Yankee Stadium loads more than in 1950. In 1952 only God knows.

But this the rest of us know. In practically every case, the accident could have been prevented—another way of saying somebody was at fault. In the military, there are no accidents. Somebody is always to blame.

The record is a lot more than what the President called "shocking." The question is, What are we going to do about it?

Education is fine, but a man whose house is on fire doesn't lecture about "fire prevention." Cooperation is wonderful but there are times to stop reasoning with a child and start spanking.

In short, it's time to get away from the banquet table and the mealy-mouthings about safety and get out in the plants and get some hair and tempers bristling.

If your safety director isn't all over the plant needling everybody in sight about safety all day long

—get a new one! If your worker won't keep the rules
—fire him! Otherwise you may bury him.

Dammit mister, your plant's on fire!

Our Nest Egg in Research

Certainly nobody who reads these pages has any doubt that our educators have done infinitely more than pay lip service to make research the philosophy upon which the chemical industry has been built.

Living in what John McKeen has called the "shadow of obsolescence" has meant more research by more people to give us "better things for better living."

And how has the educator acquitted himself of his responsibility to leave his imprint in the book of fundamental knowledge and applied practice?

You'll find the answer on page 134.

The Engineering College Research Council has made a study of all the American colleges and universities to find out what our research potential is in all the engineering and related sciences.

Here are some brief highlights reported from the chemical engineering laboratories on the campuses:

- More than 8 out of 10 qualified chemical engineers on American college faculties have research work in progress. That's a proportion higher than any other physical and engineering science.

- In all, the efforts of the professors equal that of 280 full-time senior research engineers. The work of assistants and graduate students equals that of 807 full-time junior researchers.

Merely let us point out again that the unsung and underpaid teacher is the best insurance against obsolescence that we can hope for.

Chemical Rat Races?

It isn't often that we get hot under the collar at the chemical industry or at the behavior of its members. On the whole, chemical firms are straight-shooters, even in the heat of competition.

But all this ranting about chlorophyll and soil conditioners gets our dander up. To us, these two fields are beginning to look like rat races.

The race to put chlorophyll into just about everything evidently hasn't hit its peak. But already it's hard to see how some of the claims can be justified. One count shows some 96 chlorophyll-containing products now on the market. They range from chewing gum to dog foods, from shampoos to shoe insoles, from tooth paste to toilet paper.

Many of the claims are sober, factual and legitimate. Others, we suspect, aren't. Most of the wilder claims, it's true, come from customers of the chemical industry rather than from the industry itself. But who will catch the brunt of the public's eventual awakening? The chemical industry, of course.

Meanwhile, the race in soil conditioners goes on apace. Monsanto took the wraps off its Krilium last December: then came the mad scramble to jump on the soil conditioner bandwagon. Now more than 30 products are on the market. Many are accompanied by fantastic claims and garish newspaper ads. And yet one set of comparative tests indicates that at least half of them are well-nigh worthless when used as recommended.

So here is another important new development—a fundamental and basically sound chemical contribution to man's welfare—that is being exploited and damaged by a handful of irresponsible firms panting to cash in fast. Again it is the general public that's being duped and the chemical industry that is running the risk of getting another black eye for the excesses of a few of its customers.

We have nothing against competition. We're all for it as long as it's clean and on the level. But we're dead set against competition that's marked by exaggerated claims, exorbitant prices, lack of responsibility to the consumer.

That's why we're upset by some of the things now happening in the chlorophyll and soil conditioning fields. For the good of the public and for its own reputation, the chemical industry should discourage such excesses and take decisive steps to keep these fields on a sober and ethical basis.

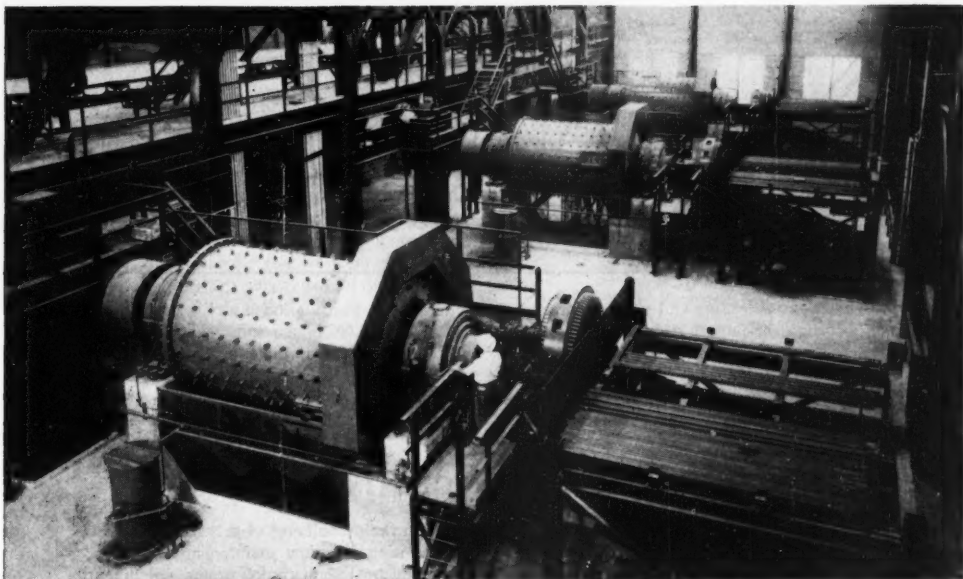
We've Noticed That . . .

Median age of the 45,000 chemical engineers in the U. S. is 32 years, making them one of the youngest professional groups in the country. National Scientific Register's survey shows that 31 percent are in research and development, 28 percent in production and 12 percent in design. Median income in mid-1951 was \$5,600—a figure that's out of date now.

Delaney's committee has turned in its report on the fluoridation of public drinking water. Principal conclusions: (1) fluoridation is a local problem, needs no Federal legislation; (2) there are still some questions on the safety of the fluoridation program; (3) it's better for a community "to err on the side of caution." Safe conclusions all—particularly the first.

Du Pont has just celebrated its 150th anniversary (p. 216). We congratulate the company on what it has done and the 87,000 men and women who make Du Pont what it is today: a leader in a leading industry.

MCA's pilot opinion survey shows that the public is still pretty ignorant of the chemical industry: it's a dangerous and unhealthy place to work, needs a lot of government regulation, doesn't have a great deal of competition. MCA—and all of us—have a whopping public relations job ahead.



BATTERY of three rod mills. Each is 8 by 12 ft. and driven by a 400-hp. synchronous motor.

SIZE REDUCTION

A lot has happened in this important field since our May 1938 special issue on mechanico-chemical processing. This report will bring you up to date. It majors on the selection of crushing, grinding and pulverizing equipment.

JULIAN C. SMITH

CHEMICAL ENGINEERING REPORT—AUGUST 1952

DESPITE the differences in size-reduction problems and in the properties of the materials handled, there are only about eight distinctly different ways of making small pieces out of big pieces. And only four are widely used by commercial machines.

Four ways
to reduce
size

They are:

1. Slow compression.
2. Impact.
3. Attrition.
4. Cutting or tearing.

These principles have been familiar ever since

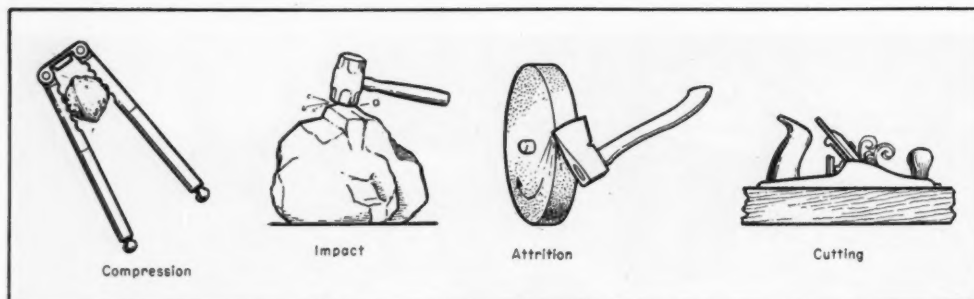
JULIAN C. SMITH is associate professor of chemical engineering at Cornell University, Ithaca, N. Y. Prof. Smith, you may remember, wrote a comprehensive report for us last year on glass and its place in the chemical processing industries.

early man stepped on something to break it, or jumped on it, or rubbed it between two rocks, or tore it apart with his teeth. Solids fail in tension, too, but except in machines for measuring tensile strength little size reduction is done through application of tension alone.

Another way of mechanically reducing particle size is explosive disintegration. A gas trapped inside the particles is caused to expand suddenly, shattering the material. This method, however, has found few commercial applications.

Another
way

Often two or three different methods of breaking are involved in a single machine. In general, slow compression is limited to coarse crushing of hard materials. Impact alone and attrition alone are used most with softer, non-abrasive feeds. Simple cutting operations are restricted to a rather narrow field. However,



combinations of loading and attrition, or impact and attrition, or impact and cutting, can break any ordinary feed to almost any desired product size.

At the bottom of the scale of sizes are colloidal products. They are often produced by

colloid mills which grind and disperse a solid into a liquid. (Although some colloid mills actually reduce the ultimate particle size, their principal action is the dispersion of agglomerates. These mills, therefore, are considered outside the scope of this report.)

Select Your Size Reducer Properly

Size reduction is a general term, encompassing a multitude of specific operations, such as crushing, grinding, cutting, cracking, shearing, shredding, pulverizing, granulating, rubbing, defiberizing and hulling. Ultimately, the process engineer who must select size-reduction equipment may well ask, "Is there one machine of many types that is best, or do various kinds of crushers and grinders do much the same job? If one type is best, how should I select it?"

Every problem different

Generally speaking, different mills do different jobs, and usually one particular type is best for a particular problem. Selection should be in terms of performance and of cost, especially operating cost. The purchase price itself has small

effect on the over-all cost of the machine during its operating life; low maintenance costs and reliability are the marks of proper equipment.

To begin his search for the most suitable machine, the engineer should arm himself with as much knowledge of the problem as he can. He should know the moisture content, the hardness and abrasiveness, the impact resistance, and other properties of the material to be crushed.

He should know the particle size of the feed, especially the maximum value; the tonnage per hour required; and the particle size and other characteristics desired in the product. He should then look for the size-reduction machine that produces a maximum amount of that product

Knowledge necessary

How Typical Size Reducers Perform

Type	Action	Typical Feed Sizes	Typical Product Sizes	Capacity Range Tons/Hr.	Power Required Hp.-Hr./Ton	Used Extensively For	Not Usually Used For	Remarks
Jaw crushers	Compression	6-72 in.	1-11 in.	10-1,000	0.3-1	Medium and hard rock	Soft, sticky materials	
Gyratories	Compression	6-72 in.	1-11 in.	35-3,500	0.2-0.7	Medium and hard rock	Soft, sticky materials	
Large	Compression and impact	1-10 in.	3/4-1 1/2 in.	10-600	0.5-3			
Small								
Roll crushers	Compression	3/4-3 in.	3/4-3/4 in.	3-150	1-1 1/2	Medium and tough, abrasive feeds	Large slippery lumps	Gives few fines; reduction ratio 4:1
Smooth	Shear, attrition, impact	3-20 in.	2-8 in.	5-1,000	0.2-0.5	Friable feeds	Hard rock	Gives few fines; reduction ratio up to 8:1
Toothed								
Revolving mills	Attrition (impact)	3/4-1 in.	4-28 mesh	3-120	0.5-4	Pregrinding abrasive feeds	Fine grinding	
Rod	Attrition and impact	30 mesh to 1 in.	20 to -200 mesh	0.5-75	10-20	Fine grinding abrasive feeds	Soft materials	Often used for mixing and blending
Ball, pebble, tube, compartment								
Hammer mills	Impact	10 mesh to 10 in.	48 mesh to 1/4 in.	0.2-600	0.5-10	Abrasive feeds	Fine grinding	Handles damp feeds
Impactors								
Swing hammer mills, hogs	Impact and attrition	20 mesh to 40 in.	-325 to 2 in.	0.05-400	1-200	Almost any nonabrasive material	Abrasive feeds	Coarse to ultrafine reduction
Cutters and shredders	Cutting	1-12 in.; wide sheets	4-100 mesh	0.1-10	10-25	Soft lumps; fibrous, rubber, plastic materials	Hard materials	
Ring roll mills, bowl mills	Rolling compression	20 mesh to 1 in.	-325 to 20 mesh	0.02-20	5-200	Soft to fairly hard materials	Abrasive feeds	Large amount of fines produced; mill usually air swept
Attrition mills	Attrition	3/4 to 1 in.	-200 to 20 mesh	0.2-5	15-200	Soft, fibrous materials	Hard, abrasive feeds	
Fluid energy mills	Impact (attrition)	100 mesh to 3/4 in.	1-30 microns	0.1-10	*	Moderately hard, friable feeds	Soft, sticky materials	Ultrafine reduction

* 1-4 lb. of steam or 6-9 lb. compressed air per lb. of product.

with a minimum of power and a minimum of wear on the working parts.*

A few principles

There are some guideposts in selecting proper equipment. Highly abrasive feeds, for example, require slow-moving equipment to avoid excessive wear, although sometimes it is economical to sacrifice one replaceable part in a higher-speed unit for over-all economy.

Gyratories and jaw crushers are used for coarse reduction of abrasive substances, and revolving mills for fine reduction. Impactors, which break by "free-air" impact and contain no grate or screen, can also handle abrasive feeds even when damp. Materials of moderate abrasiveness are reduced most often by rolling compression, as in ring granulators, ring roll mills, and bowl mills; soft, nonabrasive feeds are ground in hammer mills and attrition mills.

Particle size of the feed and product determine to a considerable extent the kind of mill to be used—coarse crushers at one extreme and fluid energy mills (or colloid mills) at the other. The size range of the product also influences the choice, for some types, like ring roll mills, give a large amount of fines; others, like crushing rolls, give few fines; and some, like slitters and special cutters, turn out no fines at all.

Go to the manufacturer

After making a preliminary selection of the type or types of mills, the engineer should consult the manufacturers of the types he has chosen. They can tell him whether their machine is adaptable to his problem; they may suggest ways of avoiding difficulties by pretreating the feed, cooling the mill, or by other means; they will make pilot-plant or full-scale tests, often free of charge.

It is in the laboratories of the equipment manufacturers, under the eyes of men who have had years of experience, that most size-reduction problems are solved.

In installing and operating size-reduction equipment consider the operation in its entirety, and do not restrict your attention to the reduction equipment alone. The pretreatment of the feed, and accessories such as screens and classifiers, often are vitally important.

Consider costs

Of the costs of operation, the two most significant items for size-reduction machines are power requirements and maintenance. Because nearly all reduction equipment is continuous and often handles large tonnages, operating labor costs are small.

Despite the mechanical improvements in size-reduction equipment, some kinds of materials

* In continuous processing, machines most often operate on a once-through basis, separating the acceptable material, and returning the oversize for further reduction. This is known as closed-circuit grinding; in open-circuit grinding the oversize is not returned to the machine.

Another common term in size-reduction operations is free crushing, in which the crushing elements are able to work on each particle independently, as if no other particles were present. It is usually, though not always, more effective than choke crushing, in which the machine is heavily loaded, and partially crushed particles interfere with the crushing of the larger lumps of feed.

Where You Can Buy Size Reducers†

Company	Address	Types Made*
Allis-Chalmers Mfg. Co.	Milwaukee 1, Wis.	1, 2, 3, 4, 5
American Pulverizer Co.	1139 Macklind Ave., St. Louis 10, Mo.	3, 5, 7
Babcock and Wilcox Co.	85 Liberty St., New York 6, N. Y.	6
Bacon-Greene and Milroy	205 Church St., New Haven 10, Conn.	1, 3
Bauer Bros. Co.	Springfield, Ohio	3, 5, 8
Blaw-Knox Div., Blaw-Knox Co.	Pittsburgh, Pa.	9
Bradley Pulverizer Co.	Allentown, Pa.	6
Buffalo Hammer Mill Corp.	27 Washington St., Buffalo 3, N. Y.	5, 7
J. H. Day Co.	Cincinnati, Ohio	3
Eagle Pencil Co.	703 E. 13th St., New York, N. Y.	9
Foster-Wheeler Corp.	165 Broadway, New York 6, N. Y.	4
Hardinge Co.	York, Pa.	4
International Engineering	Dayton, Ohio	3, 4
Jeffrey Mfg. Co.	Columbus 16, Ohio	3, 5, 7
Marco Co.	3rd and Church Sts., Wilmington 50, Del.	10A
Mead Mill Co.	14620 E. Seven Mile Road, Detroit 5, Mich.	5
Mercer Robinson Co.	30 Church St., New York 7, N. Y.	5, 7
Micronizer Co.	943 New Albany Rd., Moorestown, N. J.	9
Mine and Smelter Supply Co.	Denver, Colo.	4
Nordberg Mfg. Co.	Milwaukee 7, Wis.	1, 2, 4, 5
Patterson Foundry and Machine Co.	East Liverpool, Ohio	4
Pennsylvania Crusher Co.	Liberty Trust Bldg., Philadelphia 7, Pa.	1, 2, 3, 4, 5, 6
Prater Pulverizer Co.	1825 South 55th Ave., Chicago, Ill.	5
Pulverizing Machinery Co.	Chatham Road, Summit, N. J.	5
Raymond Pulverizer Div., Combustion Engineering Co.	1315 No. Branch St., Chicago 22, Ill.	5, 6
Reduction Engineering Corp.		9
Riets Mfg. Co.	150 Todd Road, Santa Rosa, Calif.	5
Chas. Ross and Son Co.	148-156 Classon Ave., Brooklyn 5, N. Y.	3
Smith Engineering Works	E. Capitol Drive at N. 12th St., Milwaukee 12, Wis.	1, 2, 3
Sprout, Waldron and Co.	Muncy, Pa.	3, 5, 7, 8
Straub Mfg. Co.	507 Chestnut St., Oakland, Calif.	1, 2, 4
Sturtevant Mill Co.	Harrison Square, Boston, Mass.	1, 3, 5, 6, 8
Traylor Eng. and Mfg. Co.	Allentown, Pa.	1, 2, 3
Union Process Co.	Akron, Ohio	10B
Universal Road Machinery Co.	Kingston, N. Y.	1
U. S. Stoneware Co.	Akron 9, Ohio	4
Williams Patent Crusher and Pulverizer Co.	2701 N. Broadway, St. Louis 6, Mo.	5, 6

* Types: (1) Jaw crushers. (2) Gyratory crushers. (3) Roll crushers. (4) Revolving mills. (5) Hammer mills, impactors, hogs, rolling ring granulators. (6) Ring roll mills, bowl mills, ball-bearing mills. (7) Cutters and shredders. (8) Attrition mills. (9) Fluid energy mills. (10) Special mills. (10A) Kom-Bi-Nator. (10B) Szegvari Attritor.

† Hundreds of manufacturers, both large and small, are in this field. This list is far from complete, but gives a representative cross-section of companies selling to the process industries.

give a great deal of trouble when a fine product is desired. Waxy and fibrous substances are the chief offenders.

Novel techniques, however, have solved a number of difficult problems, and in some cases have created really new forms, with remarkable properties. Among the tricks that have been played are drying, grinding in inert atmospheres, grinding sludges or slurries, making use of grinding aids, precompression of fibrous materials, and grinding at reduced temperatures.¹

New techniques

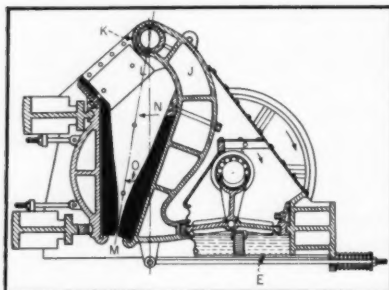
With low-melting solids it has been common practice for some time to include dry ice with the mill feed. Very recently, grinders chilled with liquid nitrogen have successfully pulverized tough plastics, lard, beeswax, and other difficult or sensitive feeds at temperatures well below —100 deg. F.²

What Various Size Reducers Can Do

Size-reduction equipment is usually divided into primary crushers, secondary or intermediate crushers, fine grinders, and ultrafine grinders.

Primary crushers usually crush run-of-mine material, accepting anything that comes from the mine face. Ultrafine grinders give products with maximum particle size as small as 1 micron or less.

Problem of definition Intermediate grinders and fine grinders defy exact definition. The terms "coarse" and "fine" mean different things to different people. While jaw crushers and fluid energy mills fall neatly into particular classes, others, such as hammer mills, can be used to give coarse products, fine products, and ultrafine products as well.



Jaw Crushers

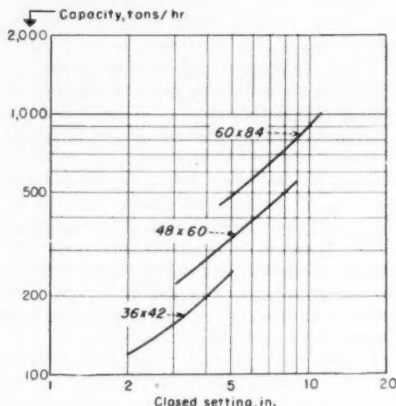
Simple slow compression is most used for coarse breaking of hard materials such as rock. The oldest and in many ways the simplest type of crusher is the jaw crusher, which applies great compressive loads on lumps caught between a fixed jaw and a movable jaw driven by an eccentric. These crushers are rugged, and within their limitations do an excellent job. Some machines are still in operation after 50 years of continuous service.

While the principle of all jaw crushers is the same, the precise characteristics and mode of operation differ considerably from one type to another.

First jaw crushers The two earliest types were the Blake crusher and the Dodge crusher. In Blake crushers the moving jaw swings from a pivot at the top, so that the discharge opening varies during each stroke; in Dodge crushers the discharge opening is almost constant, since the pivot is at the bottom of the moving jaw.

Dalton crusher The Dalton crusher, invented over 80 years ago, is a single-toggle machine with an overhead eccentric, giving the movable jaw some up-and-down motion. Recently a jaw crusher with no rubbing action and a pivot point above the center line of the space between the jaws has come on the market.

The Dodge crusher is the most limited of the



JAW CRUSHERS—Capacities at various settings for three different sizes of feed opening.

several types of jaw crushers. It is not made with feed openings larger than 11 × 15 in., and because of its tendency to choke it handles only dry feed containing no talc or clay.

Ordinary machines crush from 3 to 20 tons per hr. Even though the discharge opening is almost constant, a Dodge crusher produces some 15 percent of oversize material which must be returned for further crushing. The Dodge best finds application for small tonnages of dry materials, where considerable fines are desired.

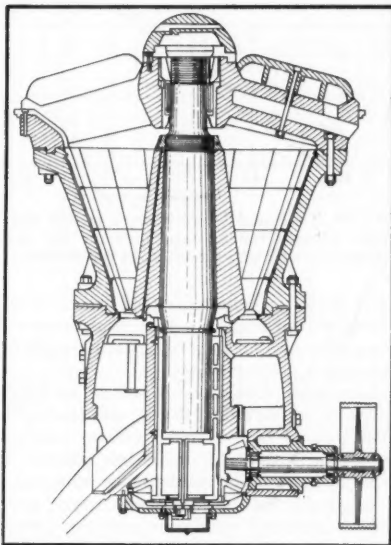
Blake machine Blake machines, modified and improved but differing from the original designs only in details, are the most common jaw crushers. In feed opening they range in size from 4 × 6 in. to 72 × 96 in. They handle much larger quantities of rock than Dodge crushers, up to 1,000 tons per hr. or more.

The fixed jaw is usually vertical and flat; the movable jaw inclined with a curved face. In some machines, such as the Traylor H and HB crushers, the fixed plate is curved at the bottom to reduce choking tendencies. Special heavy-duty crushers with long jaws, like the Allis-Chalmers A-1 crusher, can handle very tough abrasive materials, with compressive strengths up to 80,000 psi. Usually the jaws close 250 to 300 times per min.

Kue-Ken Simplex The Kue-Ken Simplex crusher features an overhead pivot above the jaw opening; curved jaw plates avoid rubbing the material being crushed. It gives the maximum leverage on large rocks; operates at higher speeds (350 to 425 strokes per min.), and is said to have higher capacity with less wear on the jaws than other designs. It is also said to require less power for a given throughput than indicated in the graph. It is made with feed openings from 7 × 12 in. to 48 × 60 in.

As in all crushers, provision must be made in jaw crushers for releasing uncrushable material, such as tramp iron, or for stopping the machine before it is damaged. Shear pins, punching bars, or overload releases between pulley and drive shaft accomplish this. In the new models, seals to protect moving parts from dust, and improved lubrication, are important features.

Uses Jaw crushers are used for primary and secondary reduction of hard materials, handle moderate to very large tonnages. Product sizes range from 4 in. maximum to 10 or 11 in. They are extensively used, especially in distant or inaccessible mines where ruggedness and simplicity are so essential.



Gyratory Crushers

Gyratory crushers are primary and secondary reduction machines for the same sort of rock as jaw crushers, with moderate to extremely large rates of throughput. They may, in fact, be considered as a modified jaw crusher, with a circular jaw opening.

How they work They have a conical crushing head which gyrates on an eccentric vertical shaft inside a conical chamber. At any point on the periphery of the crushing head, the action is the same as that of a jaw crusher. As the head gyrates, it first moves away from the wall at any given point, allowing uncrushed material to drop a short distance. It then moves toward the wall, compressing the lumps until they fracture.

In contrast to jaw crushers, however, gyratories are truly continuous. The load on the motor is uniform, or nearly so; the throughput for a given size of machine is greater; there is often less maintenance; and the power requirement per ton of crushed material is smaller.

Gyratories, like jaw crushers, are made for both intermediate crushing and coarse crushing. The biggest single crushing machines made are gyratories, some of which handle up to 3,500 tons per hr. Recently gyratories have been used for surprisingly fine crushing; one manufacturer reports successful production of 10-mesh material from a hard rock, by choke feeding a small gyratory.

Big gyratories have a pillar shaft supported from a spider at the top. The heads and chamber walls are often simple, long cones, with a small angle of taper. The head is held to the shaft by a self-tightening nut. The shaft is of high-grade open-hearth steel, often hollow bored; the head is solid chilled iron, or covered with a renewable mantle of manganese steel. The surface of the head may be smooth or corrugated. The walls of the chamber (the concaves) are often curved for about 30 percent of their length from the bottom up, to eliminate or minimize choking.

In the Nordberg design the head and concaves are bell-shaped, so that choking at the minimum opening is almost impossible. The Kue-Ken Gyracone crusher features compression without rubbing, by proper location of the center of gyration of the crushing head. As in jaw crushers, increased capacity, reduced wear and diminished power requirements are said to result.

Big gyratories are enormous machines. In some, the crushing head alone weighs 90 tons, and nine railroad cars are needed for shipment.

The giants, however, are not the concern of most chemical engineers; the smaller gyratories, for secondary or intermediate size reduction, are more common. Typical performance data for such machines are graphed (p. 156).

In one typical unit, the Allis-Chalmers Hydrocone, the crushing head is hydraulically supported, and by changing the amount of oil in the chamber below the head, the product size is readily changed. Hydraulic support also permits instantaneous relief to allow for tramp iron, with automatic reset when the uncrushable piece is discharged.

Three types of crushing heads are standard—coarse, intermediate and fine; 60 to 75 percent of the product passes through a sieve with openings corresponding to the close-side setting. The eccentric throw is varied to suit the material crushed, and ranges from 3/16 to 2 in. For fine feeds, a wobble-plate feeder on top of the crushing head is often used.

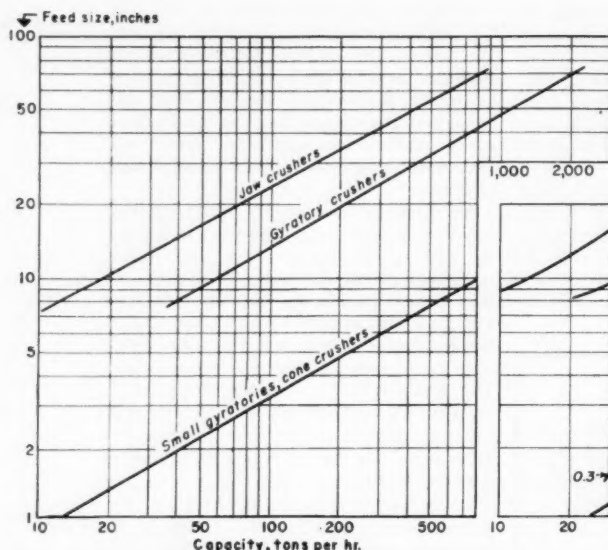
In the Nordberg Symons cone crusher, the head is supported entirely from below on a large spherical bronze socket bearing attached to the frame. There is no spider. The bowl is screwed into the top of the frame, to give the desired clearance between the head and the bowl.

The head is a simple cone. The bowl has circumferential corrugations to hold the coarse

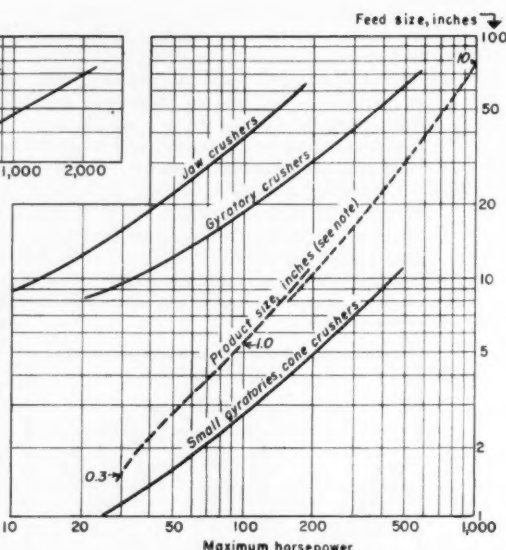
Special designs

Hydrocone

Nordberg Symons crusher



JAW, GYRATORY AND CONE CRUSHERS—Capacities, based on hard friable material with product bulk density of 100 lb. per cu. ft.



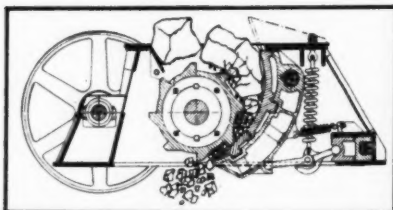
POWER is indicated by solid curves; product size by dashed curves, left-hand one for small gyratories and cone crushers, right-hand one for large gyratories and jaw crushers.

lumps for the first impact, and a smooth lower face paralleling the lower part of the head. This crusher gives little oversize as most lumps are compressed at least five times.

A set of external springs holds the bowl to the frame and releases the bowl when tramp iron falls into the machine. Standard machines are for fairly coarse reduction; short-head machines produce lumps 10 mesh to $\frac{1}{4}$ in. The Telsmith Gyrosphere is also a spring-relief small gyratory for fine crushing.

Capacity factors

The productive capacity of any given gyratory depends on the jaw setting and on the impact strength of the feed. Perhaps surprisingly, the compressive strength of the material has little effect on capacity. There is only a 10 percent change in capacity from the softest stone to the hardest rock. Capacity varies with the speed of gyration of the head, which cannot ordinarily be varied by the operator of the machine.



Roll Crushers

How they work

Most smooth rolls crush by simple compression; corrugated rolls combine compression and attrition; toothed rolls compress, tear and some-

times shatter the substances they handle. Fine milling of food products and pigments is sometimes done by smooth rolls mounted in pairs, operating at different speeds.

Smooth-face double-roll crushers are used for secondary size reduction; that is, with feed sizes from $\frac{1}{2}$ to $2\frac{1}{2}$ or 3 in., and products ranging from $\frac{1}{4}$ in. to about 20 mesh. Their typical operating characteristics are shown on next page.

In general, the rolls are rather narrow, and large in diameter. Typical sizes range from 24-in. diameter by 16-in. face, to 78-in. diameter with a 36-in. face. The smaller rolls turn at 300 rpm., large rolls at 85 to 100 rpm. The peripheral speed of the larger rolls, even so, is higher than that of small rolls.

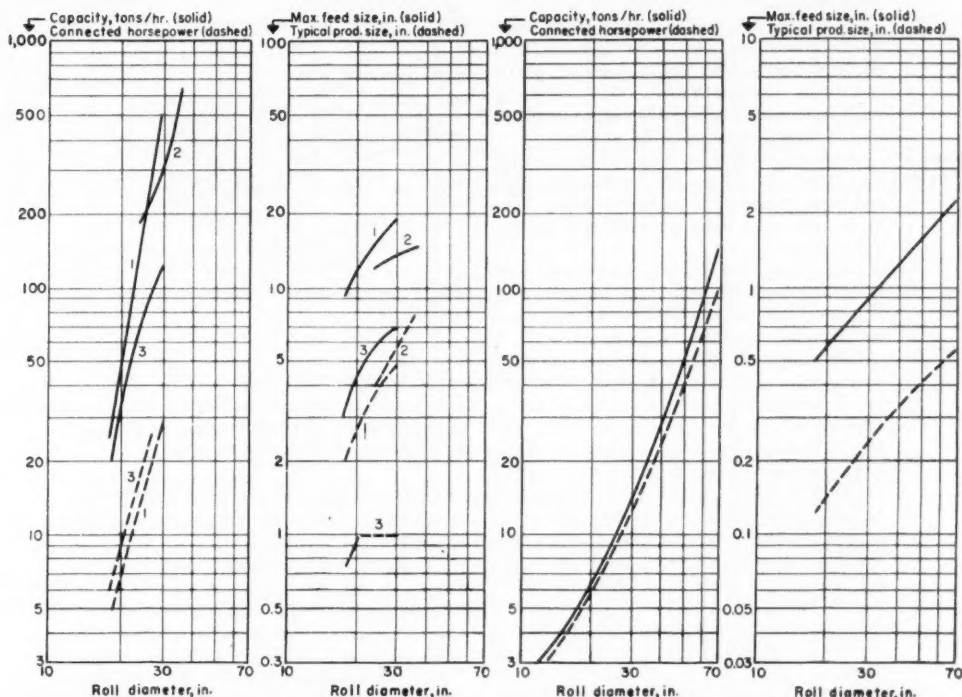
The maximum allowable size of feed to smooth-roll crushers is primarily a function of the roll diameter. The feed should not contain lumps that cannot be nipped by the rolls, and because the angle of nip for most substances is about 31 deg., large rolls will crush much larger pieces than a small roll.

The maximum allowable feed size is also affected by the spacing between the rolls. The reduction ratio recommended is 3:1 or 4:1; that is, a 1-in. feed should be crushed to about $\frac{1}{4}$ in.

Capacity is also a function of the roll diameter and the roll spacing. As with other crushers, a coarse product can be made at a high rate, while the same machine will produce finely crushed material at a slower rate. Throughput may be estimated from the peripheral speed and the roll spacing, because the product should occupy from $\frac{1}{4}$ to $\frac{1}{2}$ the volume of the theoretical

Feed size

Capacity factors



TOOTHED ROLL CRUSHERS—(1) Double-roll, toothed, on coal; (2) single-roll, toothed, on limestone; (3) double-roll, corrugated, differential speeds, on coal, rock salt.

SMOOTH ROLL CRUSHERS—Based on medium hard rock, product bulk density, 100 lb. per cu. ft. Maximum feed size refers to size above setting between rolls.

ribbon discharged from between the rolls. Incidentally, the presence of slippery round pieces in the feed appreciably lowers capacity.

Roll pressures The pressures between the rolls are great. Typical values for Traylor roll crushers are 5,500 lb. per lineal in. of small rolls, up to 40,000 lb. per lineal in. in the large heavy-duty crushers. To allow for tramp iron, one roll is always spring mounted; in Sturtevant machines both rolls are spring mounted.

Flaking mills Flaking mills are heavy-duty smooth-roll crushers that process materials like corn, wheat and rice. Roll diameters are typically 15 to 32 in. Some flakers are water cooled; some operate at room temperature; others, especially those used for flaking oily materials like soybeans prior to extraction, are heated with gas flames to about 600 deg. F. Adjustable stellited scraper blades and an insulated housing are used when operating flakers at high temperatures.

Sometimes one roll turns slightly faster than the other, as in International roll crushers, giving a tearing action as well as compression. Fine milling of softer materials is often done with special differential-speed roll mills like the Allis-Chalmers Air-Set and Ross 3-roller mills.

For such service, the roll diameter is typically 6 to 16 in. The rolls are usually chamber-bored

for water-cooling, and sometimes carry shallow corrugations. Usually two or three pairs of rolls are mounted in a single machine. Often the rolls are centrifugally cast, with a face of chilled white iron on a core of softer gray iron.

Disintegrators Disintegrators are differential-speed roll mills that tear the substance fed. Many of them, like the Traylor disintegrator, consist of rolls with shallow corrugations cut across the roll face at a slight angle to the axis. The roll speeds range from 180 rpm. vs. 145 rpm. in large disintegrators, to 300 rpm. vs. 250 rpm. in smaller machines.

In other models, such as that of International Engineering, the large slow roll has a very hard surface. Here the smaller faster cutting roll is fitted with two horizontal heat-treated steel bars for cutting and tearing. The slow roll may turn at 150 rpm. and the cutting roll at 900 rpm. These machines reduce size not only by compression and attrition, but also by impact.

Toothed roll crushers Toothed rolls, not limited by the nipping problem inherent in crushing with smooth rolls, can handle much larger feed. Some heavy-duty toothed double-roll units are used as primary crushers for coal. Feed sizes range up to 20 in., and capacities up to 500 tons per hr.

Teeth are pyramidal. Similar units with blade

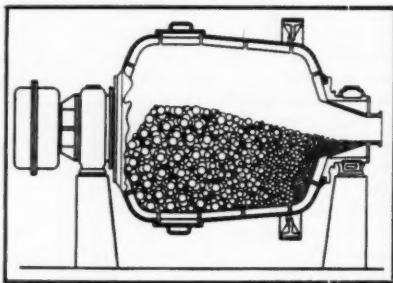
teeth, parallel to the roll axis, or saw teeth, normal to the axis, are used for breaking coke. Sawtooth crushers with wide rolls—small in diameter—handle filter cakes, sheets of plastic and rubber, and similar feeds. They operate by shear and compression. Unlike high-speed cutters, they do little breaking by impact.

Single-roll crushers Single-roll toothed crushers pull the feed between the roll and an anvil or breaking plate and break it, tear it, or crush it to pieces. They handle somewhat softer materials than double-roll crushers.

Jeffrey single-roll crushers have both pyramidal and saw teeth (not all of the same size) that effectively break substances like coal, bone and alum. Many other makes are similar.

Other single-roll crushers carry lugs that break by impact, and do no tearing. Such rolls, turning at somewhat higher speeds, fall in a class between roll crushers and impact mills. The Sprout-Waldron horizontal crusher includes a single-toothed tapered roll that does the primary breaking. It also has a secondary grinding zone in which the crushed product from the roll is rubbed between a rotating tapered cone and a stationary housing. It handles substances like soft shale, burnt lime and crystalline chemicals.

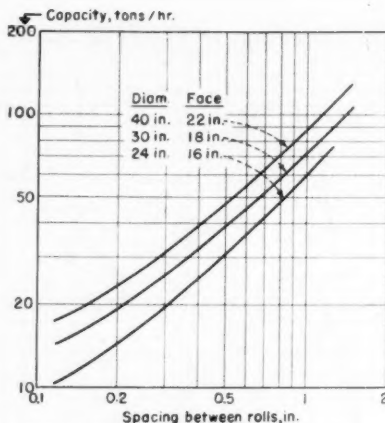
Sometimes, the single roll is vertical and conical, carrying heavy corrugations and turning 300 to 1,100 rpm. inside a corrugated casing, crushing 1 to 10 tons per hr. of soft or moderately hard feeds without producing a lot of fines. The Sturtevant rotary crusher is an example of this kind of machine.



Revolving Mills

A revolving mill, one of the most familiar types of size-reduction machines, has a cylindrical shell rotating fairly slowly on a horizontal axis, filled to about one-half its volume with rods, balls, or pebbles as the grinding medium. For intermediate and fine reduction of abrasive materials, revolving mills are unequalled.

Different types There are many modifications of the basic design. Short, large-diameter cylinders characterize the ordinary rod mills, ball mills and pebble mills. Long cylindrical mills are called tube mills or compartment mills. For high efficiencies with some products, conical mills are used. Sometimes the cylinder wall of a revolv-



SMOOTH ROLL CRUSHERS—Effect of roll spacing on capacity for three different sizes.

ing mill is perforated; more often it is solid, with the ground product discharging at one end, or, sometimes, at the center.

The Pennsylvania Bradford breaker is an example of a mill with a perforated shell. It contains no grinding medium; the lumps of feed, usually coal, are lifted by radial shelves and break by impact on heavy perforated plates. After sufficient reduction, the particles pass through the screen and are discharged.

Bradford breaker

The machine simultaneously separates slate and rock that did not break. Oversize, unbreakable material travels the full length of the breaker and discharges with any tramp iron, timber or other refuse. The breaker is made in sizes from 6 to 12 ft. in diameter, handling from 75 to 1,500 tons of coal per hr.

Rod mills are used for preliminary reduction, reducing a 3-in. feed to perhaps 10 mesh. They bridge the gap between coarse crushers and fine grinders, and often prepare material for final reduction in a ball mill. The steel rods extend the full length of the cylinder, and are sometimes kept from twisting out of line by conical ends on the grinding chamber.

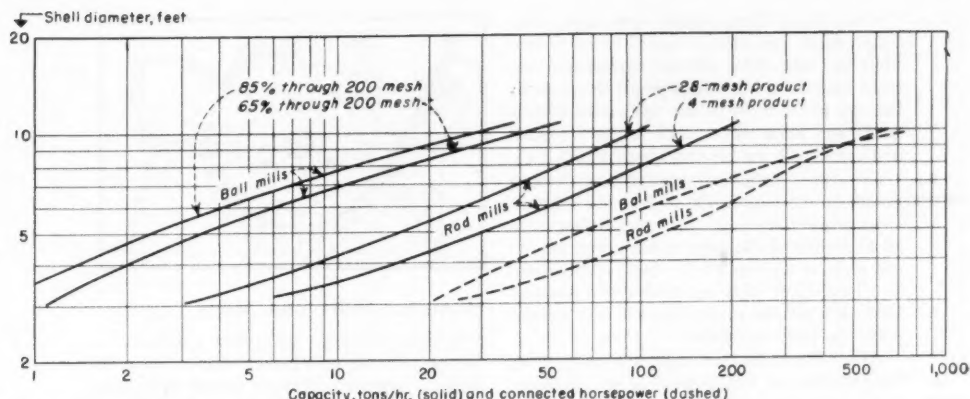
Rod mills

Rods usually vary in diameter from 1 to 5 in. with several sizes present in any given mill. Rod mills grind largely by rolling compression and by attrition, with little impact. They give a product with little oversize and a minimum of fines.

Ball and pebble mills, however, do most of their breaking by impact. The speed of rotation is such that the balls are lifted almost to the top of the cylinder before falling. If the speed is too high, of course, the balls and the feed centrifugalize; that is, they are carried around without leaving the wall of the cylinder, and no grinding takes place. This speed at which this occurs is called the critical speed.

Ball and pebble mills

Most mills operate at 55 to 85 percent of the



BALL AND ROD MILLS—Based on wet grind, open circuit, single pass, hard material.

critical speed. High percentages of the critical speed in small-diameter mills are best for impact breakage of large feed particles; low percentages give more attrition to a finer product. Recently it has been shown⁸ that lower speeds and larger mills are more economical, and that 50 percent of the critical speed is usually best.

Tube mills While most ball mills are continuous, some are operated batchwise to give very fine products, though at rather high cost. Tube mills are designed to do the same thing continuously. They grind the feed for two to five times as long as the shorter ball mill, and are excellent for re-grinding a fine powder in a single pass, where power is not of prime importance.

By putting one to three diaphragm partitions in a tube mill you convert it into a compartment mill. One compartment may contain large balls, another small balls, another very small balls, or pebbles. This segregation of ball sizes aids considerably in avoiding wasted work, since the heavy balls break only the large lumps, without interference by the fines.

Most revolving mills are operated in closed circuit, because single-stage closed-circuit is about 25 percent more efficient than open-circuit operation. Two or three-stage operation is 20 percent more efficient than single-stage. Sometimes, as in the Foster-Wheeler mill for pulverized coal, hot air is admitted to the mill, to carry the coal to classifiers which separate the acceptable fines and return the oversize.

Reverse segregation In ordinary ball mills, reverse segregation, a troublesome phenomenon, causes the smaller, worn balls to collect near the feed end where they do the least good. By making the shell slightly conical, with the discharge end a little smaller in diameter than the feed end, reverse segregation is avoided and the grinding efficiency raised by some 6 percent.⁴ The Hardinge Tri-Cone mill utilizes this principle. The Tri-Cone design is sometimes used in the first section of compartment mills.

Conical ball and pebble mills, such as those made by Hardinge and International Engineering, also have the large balls migrating to the point of largest diameter, and small balls to the smallest. Conical mills have a 60-deg. cone leading from the feed point to a short cylindrical section, followed by a 30-deg. cone reducing to the discharge.

Conical mills

Large lumps of feed are broken by the large balls in the cylindrical part of the mill. Near the discharge, the finer material is ground by the smaller balls. This method of suiting the amount of energy expended to the type of job is said to increase grinding efficiency markedly.

The grinding media are either steel rods or steel balls 1 to 5 in. in diameter. Where non-metallic media must be used, as in grinding ceramic materials, flint pebbles 2 to 7 in. in size have been used. Pebble mills, because of the low density of flint, are of light construction. They use about one-third the power and have about one-third the capacity of mills using steel balls. Porcelain balls are also used.

Grinding media

Recently other grinding media have received attention—non-metallic products considerably more dense than flint or porcelain. Zircon balls, with a specific gravity of 3.7, are supplied by the Locke Insulator Corp.; Borundum cylinders, made by U. S. Stoneware, have a specific gravity of 4.0 and a Moh hardness of 9. Such materials increase the capacity of conventional pebble mills by 60 percent or more.⁹ Their specific gravities compare with 2.0 to 2.5 for flint, 2.3 to 2.5 for porcelain, and 7.8 for steel.

A major point of wear in revolving mills is the liner. Often liners are of high-carbon steel plate carrying longitudinal steel lifting bars. Flights of some kind are almost always used, because smooth liners have too much slip. Lifters that protrude too far, however, are also avoided, because they prevent relative motion of the balls, except when the balls actually drop. However, some rolling is desirable.

Liners take the wear

Other metal liners are the wave type, with longitudinal undulation; keyed liners, where bolts and bolt holes are not permissible; and liners with spiral lifts which propel the material through the mill. In pebble mills, smooth porcelain and Silex (silica rock) linings are used, and occasionally rubber and plastic linings.

Dis-charging Sometimes the ground product leaves through peripheral openings in the shell of the mill, but more often it discharges through a hollow trunnion. Peripheral discharge is fairly common in rod mills, at one end of the shell or at the center. Batch ball mills are loaded and emptied through a peripheral manhole, which is covered while the mill is operating.

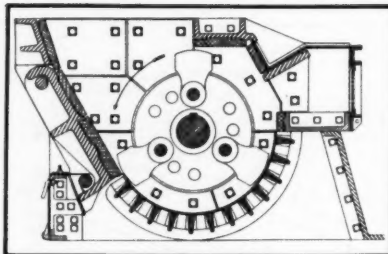
Most ball mills, rod mills and tube mills, however, receive feed at one end and discharge it from the other. In wet grinding, the liquor overflows through one of the trunnions; in dry grinding a steep gradient is usually necessary to get the material to flow through the mill. For the overflow, a slotted diaphragm, placed about 6 in. from the discharge end of the cylinder, holds back the grinding medium, and allows the pulp to flow into the space between the diaphragm and the end plate. Here the pulp is lifted and dropped to a discharge cone, which directs it out the trunnion.

Overflow trunnions result in lower capacity and give more overgrinding than do diaphragms, but they do not clog and they save wear on rods, balls or liners. As maintenance costs become more and more significant, many operators are preferentially using overflow rather than diaphragm discharge.

Dry and wet grinding Revolving mills can handle dry powders or wet slurries. Dry grinding gives less wear on liners and media, and gives a high percentage of fines in the product, but wet grinding is much more common. Grinding a slurry saves power, gives a higher capacity, permits wet screening or classification, eliminates dust problems, and simplifies handling.

Noise important In many installations mill operators actually play by ear. The noise coming from a ball mill is a pretty good indication of how it is working. The mill should be noisy, but not too noisy. Quiet operation means an overload, with the medium cushioned by too much material. Very loud bangs mean too little pulp is present. An electric ear can be used to measure the intensity of the sound, and through a feeder-controller adjust the input to the satisfactory value.

Revolving mills are also used for operations other than grinding, or in combination with other operations. The Bradford breaker simultaneously pulverizes and screens. Many dyes are ground, mixed and standardized in batch revolving mills. Jacketed ball mills house reactions between gases and solids in which the reaction product must continually be broken up—under pressures of at least 100 psi, and temperatures up to 230 deg. C. or more.



Hammer Mills and Hogs

In swing hammer mills, feed is broken by impact, followed by attrition, whereas impactor design of hammer mill breaks entirely by impact. Hammers connected to a high-speed shaft shatter the lumps, or send them flying against a corrugated breaker plate or anvil. They then rub the particles through a screen or grate. Hogs are generally similar in appearance, but the breaking elements are fixed to the shaft and operate at least in part by cutting as well as by impact.

Hammer mills and similar devices are used for almost all types of reduction—from very coarse rock crushing to the production of face powders. They handle almost anything—tough, fibrous materials; soft, wet pastes; sticky muds; steel turnings; hard rocks. Capacities range from a few pounds to hundreds of tons per hour.

Most hammer mills have a horizontal shaft and several sets of hammers. Ordinarily four or six hammers constitute a set; large mills may have ten sets. Sometimes adjacent pairs of hammers are connected by longitudinal arms; occasionally these arms extend the length of the mill.

For simple impact breaking the hammers are often plain square or rectangular bars; for heavy duty they may be sledges, with oversize cubical ends; for shredding or tearing fibrous materials they have special shapes. Except in impactors, a grate or screen beneath the hammers separates the ground from the unground. To prolong the life of the mill often the direction of rotation is reversible.

Examples of heavy-duty mills are the Pennsylvania reversible impactor, which crushes up to 600 tons per hr. of 10-in. feed; and the Jeffrey Miracle crusher, the largest model of which can be fed from a 1 or 2-yd. shovel, at rates up to 400 tons per hr. On hard rock, a hammer mill gives a more cubical product than the slabbed material from a jaw or gyratory crusher.

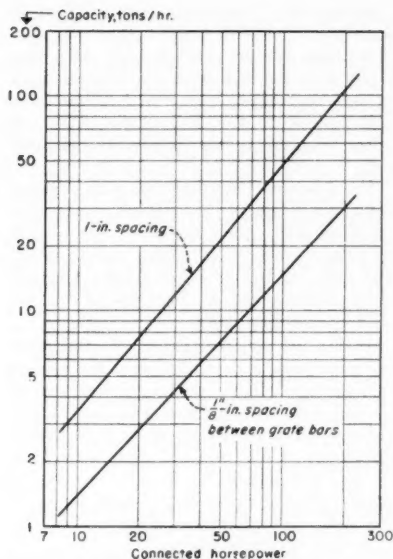
Sturtevant hammer mills and swing-sledge mills are examples of intermediate machines. Their products range from 1 in. to 20 mesh; they handle $\frac{1}{2}$ to 10 tons per hr. With limestone, the maximum feed size is 3 in. On fibrous material, it can be as large as the feed opening of the machine.

What they are used for

Types of hammers

Heavy duty

Intermediate duty



SWING HAMMER MILLS—Capacity and power based on 3 to 6-in. feed, coal and limestone.

Swing sledge mills are suitable for moderately hard and tough fibrous feeds like bark or leather. Hammer mills handle softer feeds. With sticky feeds the grate under the hammers is omitted. Those machines feature a one-piece hinged face that easily opens to expose the working parts, without disturbing feed or discharge lines.

Because of the wide range of sizes and services of hammer mills, it is not possible to relate rotor size with capacity. Capacity depends too much on the nature of the feed and the size of the product. Typical data relating power input and the capacity of heavy-duty hammer mills are shown in the graph above.

Special mills In the intermediate size range, special mills for a variety of services are on the market. Garbage grinders, steel scrap grinders, cinder aggregate grinders, shredders, cutters, choppers, mills for sugar, bagasse, waste paper, citrus peel, rubber—all are commercially available.

Recently at least two machines with traveling breaker plates have been announced. They handle exceptionally sticky feeds like wet clay. The Jeffrey Mud-Hog crusher contains no grate; it reduces 40 to 350 tons per hr. of feed to $\frac{3}{4}$ to 2 in. The Pennsylvania Dixie Non-Clog hammer mill usually includes a grate, and may be furnished with a second plate-conveyor for discharging the sticky product.

Prater grinder In the Prater gradual reduction grinders, a set of hammers of various lengths turns inside a conical screen. Feed enters at the small end of the cone. Here the shorter hammers break the part of the feed that breaks most easily.

The more recalcitrant lumps proceed toward the large end, where they are hit by larger heavier hammers with higher tip velocities. This is said to increase the efficiency by eliminating regrinding and recirculation in the mill.

The Prater dual screen pulverizer is often fed at both ends of the rotor, which turns inside cylindrical screens covering more than 70 percent of the area of the drum. Feed is broken by heavy breaker bars or knives on each end of the shaft. Roll or bar crushers fixed to the shaft work close to the surface of the first grinding drum. Swing hammer blades finally reduce the material in a second and larger grinding drum. It handles materials like distillers grains, tankage, clays and minerals.

In the Rietz disintegrator, the vertical rotor is completely surrounded by a screen. There is no grinding plate or anvil. This machine does most of its work by attrition rather than by impact. Feed admitted at the top may be broken by heavy preliminary crushing blades. Afterwards it falls into a zone containing six or more sets of fixed hammers. The shaft turns at speeds between 3,600 and 7,800 rpm., using higher speeds for more difficult jobs.

The hammers do some shattering. But to a large extent the feed is reduced by being thrown against and rubbed through the screen by what the manufacturer calls centrifugal attrition. Material that does not break may be separately removed at the bottom of the machine. The disintegrator is made with rotor diameters between 8 and 24 in., and draws from 5 to 400 hp. It processes asbestos, baby foods, peanut butter and similar substances.

Mikro-Pulverizer The Mikro-Pulverizer of the Pulverizing Machinery Co. is a high-speed horizontal-shaft hammer mill in which axial arms connect pairs of swing hammers. Unlike many hammer mills, it is often used for wet milling. Various models process from 75 to 25,000 lb. per hr. Because of the high peripheral speed of the hammers—up to 22,000 ft. per min.—it makes fine products even from difficult feeds. Screw feeders and provision for air circulation are included.

Mikro-Atomizer The Mikro-Atomizer is a fairly recent modification with an internal classifier for making ultrafine powders. The shaft carries two fans in addition to the hammers; the support rods for the hammers carry classifier blades. The fans draw air through the grinding chamber in toward the shaft and discharge it radially to ducts leading to the collectors. The air picks up the ground material and brings it radially past the classifier blades, which turn in a narrow passage between the grinding chamber and the space around the shaft.

If the particle is small enough it passes through to the discharge; if it is oversize, the classifier blades by centrifugal action throw it back into the grinding chamber for further reduction. It is a noisy, high-speed machine,

with the rotor turning at 3,000 to 6,000 rpm. A 14-in. machine typically handles 2,000 lb. per hr. of 4-in. feed and reduces it to an average particle size of 5 to 15 microns, with substantially everything passing a 325-mesh screen.

The Raymond Imp mill is also a high-speed hammer mill. Like other makes, it is sometimes used with an external air classifier to make ultrafine products. The Raymond vertical mill contains horizontal hammers on a vertical shaft. This mill is also used for ultrafine products and often for simultaneous size reduction and drying.

Hog mills

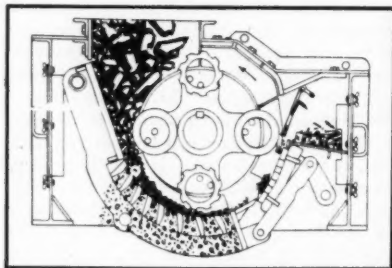
Hog mills have fixed members instead of swing hammers, and do as much cutting as they do shattering. The cutting tool may be heavy teeth, sharp blades, or spikes as in the American Pulverizer dry-ice crushers.

Shredders and cutters

True shredders and cutters have blades with highly sharpened edges. The Jeffrey rubber shredder, for example, has sets of chisel-point teeth anchored to a vertical disk on a horizontal shaft. The shaft turns above notched cutting bars in the lower chamber. It can cut crude rubber, from a coagulator or filter, into small porous pellets.

Robinson cutters exemplify the true knife cutters. The largest model contains six stationary knives, 30 in. long, set in the upper casing parallel to the rotor axis; and 12 knives, 15 in. long, held by the rotor in a shallow heringbone pattern. Its rotor turns at 350 to 1,200 rpm. and requires from 2 to 45 hp. Rotor diameters range from 9 to 24 in.

This machine is designed for coarse, medium, or fine cutting of tough materials like roots, bark, metal foil, felt and cork. It can reduce fabrics, hair, fur trimmings and like substances into fine fiber lengths suitable as flock.



Rolling-Compression Machines

Various manufacturers describe their rolling-compression machines as granulators, pulverizers, mills and crushers. Designs include machines that resemble hammer mills, with rotating rings substituted for the hammers; ring-roll mills in which rolls turn under pressure over the surface of an anvil ring or bowl; and mills with balls used in place of rolls.

Models with free-turning rings in place of hammers are used to avoid overgrinding that comes from scrubbing or scouring. Also, they do not have the high speeds of hammer mills. By replacing impact with rolling compression, it is possible to save considerable power, to reduce wear and to avoid producing too many fines.

The American Pulverizer rolling ring crusher contains four sets of rings pinned loosely to a horizontal shaft. Along the shaft smooth crushing rings alternate with toothed shredder rings. The rings are free to move radially a considerable distance, and are held against the material by centrifugal force.

Rolling ring crusher

As they roll over the lumps they break them by compression and tearing, until the product falls through a grate similar to that used in hammer mills. Various sizes used on coal handle feed lumps from 6 to 16 in. in maximum size, rotate at 600 to 1,150 rpm., draw 15 to 75 hp., and process 30 to 160 tons per hr. Another design shreds 2 to 8 tons per hr. of any metal turnings, including tough alloy steel, while drawing 40 to 150 hp.

In the Pennsylvania granulator, a second pin inside the rings insures pressure against the feed, rather than centrifugal action. Lower shaft speeds can be used, therefore. In these machines, shaft speeds are only half those used in the same size hammer mill. They feature an adjustable cage that varies the setting between the grate and the rings, and a trap for tramp iron.

Ring granulator

One advantage of ring granulators is that tramp material cannot damage the grinding elements. The rings ride over the unbreakable lumps while moving them toward the trap.

Roller mills differ considerably from ring granulators. But they too depend on rolling compression for pulverization. Usually three or more vertical cylindrical rollers are held inside a solid anvil ring or bull ring. They turn at moderate speeds and press outward against the ring with great force. Feed is caught and broken between the roll and the anvil ring. The pieces are caught in an air stream and classified; the oversized is returned.

Roller mills

Raymond roller mills and Williams roller mills are of this design. They contain three to six rollers and handle up to 50 tons per hr. of moderately hard rock. Plows lift feed from the floor of the machine and direct the lumps between the rolls and the ring. Regulating feeders insure uniform loading at the maximum permissible rate.

The Raymond Low-Side mill, containing a simple cone separator, reduces feed down to 95 percent through 100 mesh. High-Side mills, with an internal, independently driven air classifier, discharge products as fine as 99 percent through 200 mesh. Williams mills are used with an external air classifier. The Bradley roller mill

is a large machine especially suited to cement rock and cement clinker. Its three rolls press against the ring with a force of 15,000 pounds. They are driven at about 130 rpm. The ring is 66 in. in diameter; the roll diameter is 22 in. It can accept feed lumps 2 in. in size and produces 40 to 50 tons per hr. of crushed limestone.

Ring roll mills In the Sturtevant ring roll mills, the ring is vertical and the roller shafts are horizontal. The rolls are more nearly spherical than cylindrical. Here the three rolls are held stationary while the ring turns. Feed enters between the rolls from above, and leaves the machine at the bottom of the casing. A stream of air carries the product from the grinding chamber.

The ring speed is slow—75 to 125 rpm.—and the pressure between ring and rolls is high—20,000 to 60,000 lb. As in other roll mills, the naked ring is never exposed during operation to the rolls. A layer of rock intervenes, so that rock is crushed on rock. This gives a maximum of fines.

These machines are used in conjunction with an external air classifier and are not usually considered as finishing mills. They reduce 1 or 1½-in. lumps of soft to fairly hard materials to between 6 and 200 mesh, at rates between ½ and 15 tons per hr. The ring in the largest model is 44 in. in diameter with a 14-in. face; the roll diameter is 18 in.

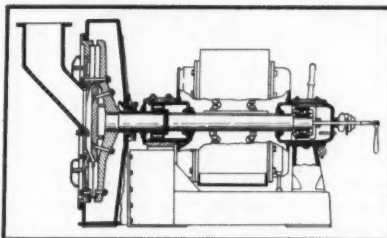
Adaptable machines Some machines designed especially for coal sometimes find application with other feeds. An example is the Raymond bowl mill, in which nearly vertical rolls turn inside a rotating bowl. Both the rolls and the bowl are tapered. The crushed coal works upward until it is caught by a circulating stream of air, which carries it to a classifier. Often the air is heated, so that the coal is dried as it is ground.

Another combination dryer and mill for coal is the Babcock and Wilcox Type E pulverizer, in which the crushing elements are steel balls 6 to 10½ in. in diameter, turning between special races with nickel-chromium-molybdenum white cast iron surfaces. The lower race is driven, the upper one is stationary.

Coal enters through a regulating feeder, passes through the grinding zone, and is picked up in a high-velocity stream of hot air. It is conveyed to a classifier immediately above the races, where oversize lumps are removed. The fines are carried through. The pressure on the balls is adjustable to very high values. The upper race is spring-mounted so that it releases if tramp material enters the crusher. Various sizes pulverize and dry 500 lb. to 300 tons per hr. of coal.

Attrition Mills

The flour mills of old, consisting of two ponderous stones with grooved faces and driven by a slow-speed vertical shaft, were attrition mills.



They rubbed and tore material apart, much as a file rubs and tears a piece of wood or metal. They ground slowly, and, by present-day standards, not exceedingly fine. Today many mills utilize the same principle.

For example, direct descendants of the old **Buhr mills** attrition mills are the Sturtevant rock emery mill and the Sprout-Waldron buhr mill. In these mills the stones are 10 to 54 in. in diameter and turn at 350 to 700 rpm. They are made of rock emery or a composite of French buhr, pebble grit, and emery; they are usually held on a horizontal shaft.

Through the center of the stationary stone a screw brings the feed to the space between the stationary and rotating stones. From here it passes outward and through the narrow gap, discharging at the bottom of the machine.

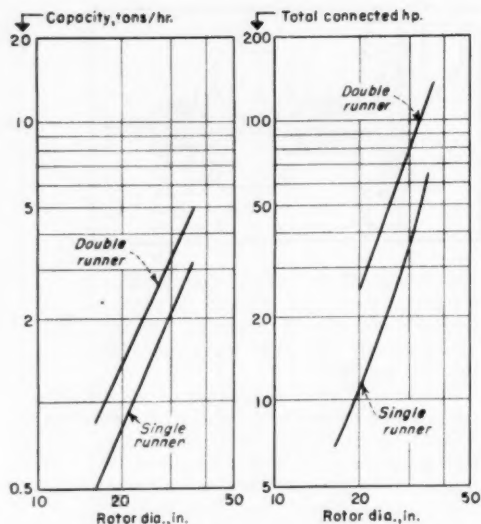
These mills take a feed ¼ in. in maximum size, and reduce it to between 20 and 200 mesh. They are designed to handle ¼ to 8 tons per hr. of soft substances like clay, chalk, talc and burnt lime, and draw 12 to 80 hp. One 42-in. model has a vertical shaft and horizontal stones. It handles 1 to 3 tons per hr. of coal, limestone, shale and similar feeds, and draws 18 hp. Rock emery mills usually produce 100-mesh material without screens. For finer products, closed-circuit operation with screens or air classifiers is necessary.

Partly because of the lack of skilled help for facing grinding stones, metal grinding plates are now most commonly used in attrition mills. Just as there are many types of files for different purposes, so there are many varied patterns of grinding plates. By changing the plate pattern, the mill speed, or the distance between the plates, widely different grinding actions can be obtained.

In many ways attrition mills are the most versatile of size-reduction machines; in fact they will do anything from rock grinding to feather curling. In general, they are used for fine reduction of soft or fibrous materials. Single-runner mills, with one stationary and one driven plate, are used for tough feeds; double-runner mills, with the opposing plates driven in opposite directions, grind to finer products but usually process softer materials.

The Robinson single-runner mills turn about 1,000 rpm. for cracking and granulating operations; at 3,500 rpm. for fine grinding or blend-

Single-runner mills



ATTRITION MILLS—Double runner $\frac{3}{4}$ to 1-in. feed, soft materials; single runner; $\frac{1}{2}$ -in. feed, tougher materials.

ing. Corrugated plates of many designs are used for grinding and shredding; plates with pyramidal teeth are used for blending pigments and insecticides; silicon carbide stones are used for grinding starch.

Frigidisc model

In the Frigidisc model both plates are cooled with water or brine, so that the mill can handle feeds that would be otherwise destroyed by the generated heat. This mill can thus handle vulcanized and unvulcanized rubber products like tire peelings and scrap heels, producing 20 to 30-mesh material.

Sprout-Waldron single-runner mills have similar applications. For defibering and granulating they contain spike-tooth plates. The power requirements, of course, vary widely, depending on the nature of the feed and the fineness of the product. Typical values are 9 lb. of product per hp.-hr. when grinding wood, to 90 lb. per hp.-hr. when processing camauaba wax.

The Sprout-Waldron refiner is a typical single-runner attrition mill for the pulp and paper industries. It is a heavy-duty mill designed to break down chips, knots and fiber bundles; all kinds of paper pulps and stocks; bagasse, straw and similar grasses. White iron plates are usually used; stainless steel plates are sometimes necessary. It is fitted with a 300 or 450-hp. motor, and grinds from 0.5 to 5 tons per hr.

Double runner mills

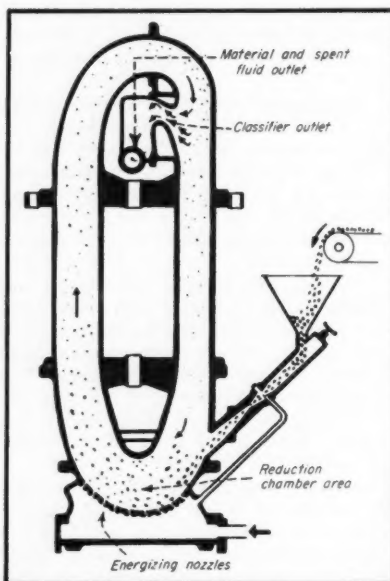
Double-runner mills have plates from 16 to 36 in. in diameter, turning at speeds from 1,200 to 7,000 rpm. The feed is almost always precrushed to $\frac{3}{4}$ to 1 in. maximum size, and enters at a uniform controlled rate. Usually, though not always, separate motors drive the opposing plates in opposite directions. Feed enters through an opening near the axis of one plate,

is caught and broken between the plates, and discharges at their periphery.

The Robinson mill features a curved arm runner head. Blades throw the feed into the grinding space by centrifugal action, permitting the mill to handle high capacities of damp or oily feeds.

Double-runner mills grind precrushed fish, gums, soap, sawdust, grains, and the like at rates between 2,000 and 12,000 lb. per hr. Air is often drawn through the mill to remove the fines and prevent choking. The air gap between the plates can be adjusted while the mill is running by moving one motor and the grinding plate assembly axially against a spring. The spring mounting permits the plates to separate if tramp material gets into the mill.

Adjustable gap



Fluid Energy Mills

In recent years, process engineers have been asked to make more and more ultrafine products. Modified hammer mills with built-in classifiers, like the Mikro-Atomizer and the Raymond vertical mill described earlier, are one solution to their problem.

Another is the fluid energy mill, in which feed is suspended in high-velocity streams of gas and broken by attrition and impact of particle on particle. These mills are characterized by the almost complete absence of moving parts and their ability to produce extremely fine products. A standard 325-mesh screen has openings 44 microns on a side; fluid energy mills make products averaging 1 to 10 microns in size, often with 100 percent smaller than 30 or even 20 microns. They all incorporate some form of classifier.

Characteristics

Micro-nizer An example of a fluid energy mill is the Micronizer. As in other mills, its fluids are almost always air or superheated steam. The Micronizer contains a shallow cylindrical grinding chamber of mild steel, white iron or stainless steel, 8 to 48 in. in diameter.

Feed to this mill, smaller than $\frac{1}{4}$ in. in size, enters an annular manifold above the chamber through a number of ports. Here it is caught in a swirl of high-speed fluid jets that enter radially from the periphery of the chamber. Particles break from impact in this zone. When sufficiently small they are carried by the expanding gas to the axis of the chamber, where many of them drop to a collector. Extreme fines pass out with the exit gas through the top of the chamber to a cyclone or bag filter. As long as the particles are oversize, centrifugal force keeps them swirling about near the rim of the chamber. Only after they are broken can they migrate to the discharge point.

Micronizers handle non-sticking feeds; but not rubbery, fibrous or resilient materials. They can process 200 to 2,000 lb. per hr. of graphite, talc, silica gel and limestone, with products averaging 2 to 6 microns in size. The minimum fluid pressure is 100 psi.

From 50 to 3,600 cfm. of air, or 700 to 7,000 lb. per hr. of steam superheated to 375-450 deg. F. is required.

Reduction-izer The Reductionizer operates on much the same basic principle. Here, reduction takes place in an oval loop of pipe 1 to 8 in. in diameter, 4 to 8 ft. high. Feed enters near the bottom of the loop. Fluid (air or steam) is admitted through several nozzles at the bottom of the loop.

Here the feed may be as large as $\frac{1}{2}$ in. but a maximum size of 100 mesh gives much better results. The fluid feed pressure is again 100 psi., but the pressure inside the loop is only a little above atmospheric. Air or steam superheated to 500 deg. or even 650 deg. F. are the fluids, although inert gas has been used with sensitive products.

Classification takes place at the upper bend of the loop where the larger particles are thrown to the outer wall and the fines congregate at the inner wall.

The takeoff leads from the inner wall to a cyclone or bag collector. The discharged fluid carries out only the fines and lets the oversize recirculate.

The Reductionizer uses 30 to 500 cfm. of compressed air, or 100 to 5,000 lb. per hr. of superheated steam. It turns out materials often averaging 1 micron in size, with no particle larger than 10 microns. Like the Micronizer, it uses 1 to 4 lb. of steam, or 6 to 9 lb. of air, per lb. of product.

Eagle mill The Eagle mill, originally designed for grinding graphite, consists of a 200-ft. loop of $\frac{1}{4}$ -in. or $\frac{1}{2}$ in. pipe. Steam or air transports the feed and lumps are broken by attrition and impact.

At the end of the loop, an ejector nozzle sends the gas-solid mixture into an expansion chamber and cyclone, where the oversize particles settle out.

Free-flowing feeds to the Eagle mill are admitted through a hopper in the wall of the cyclone; stickier feeds are pulled in ahead of the ejector nozzle. This mill reduces 10-mesh to $\frac{1}{4}$ -in. feeds to micron sizes. It has handled talc, graphite, grains, pigments, insecticides, clays and many other products. Fairly detailed information on the design and performance of Micronizers, Reductionizers and Eagle mills has been published.*

An even newer fluid energy mill is the Blaw-Knox pulverizer. It was developed to pulverize coal for fuel, with the desired product to be 90 percent through 200 mesh. But it has since been applied to many other feeds, reducing them to 1 to 20 microns.

In this mill, the feed drops into a rather narrow cylindrical chamber. Near its bottom, opposing guns or nozzles send high-velocity jets of steam or air into a head-on collision. Originally four guns were used; recent designs call for only two. The streams meet at 400 ft. per sec. or more.

Caught in this zone of extreme turbulence, the feed particles and recirculated oversize are rapidly shattered. Once again the fluid pressure is 100 psi.; reducing the pressure to 50 psi. cuts the capacity to $\frac{1}{4}$ of its normal value. With coal, the temperature used is 750 deg. F.; with other feeds, temperatures from 70 to 800 deg. F. are used.

Hot gases simultaneously dry and pulverize, so that it is possible to grind feeds containing up to 20 percent water without loss of capacity. Some designs use a cone classifier. For the ultra-fine reduction, an external mechanically operated air classifier is necessary.

When operating on coal, standard models process from 500 to 20,000 lb. per hr. For such capacities the mill is fairly small, almost noiseless. It requires no foundation, or even bolting to the floor. The Blaw-Knox pulverizer has successfully made ultrafine products from garnet, carbon black, mica, asbestos, iron ore and many other solids.

This machine, reports state, has reduced clay with an average feed size of 10 microns to a product averaging 0.7 microns in diameter. This is a far cry from the big gyratory crushers, which break 70-in. rocks into a product 2 to 10 in. in diameter.

Mills With Multiple Functions

Size-reduction equipment often performs double duty. In some units, drying accompanies the grinding; in others dry feeds are blended, or a solid is dispersed in a liquid. Still other units break pieces of ore away from worthless

Blaw-Knox pulverizer

Two birds, one stone

rock, and in conjunction with accessory machines, unmix the feed.

The Raymond bowl mill and the Babcock and Wilcox pulverizer, described above, flash dry as well as grind. Almost all types of mills do some mixing, except perhaps the primary crushers.

Marco
Kom-Bi-
Nator

The Marco Kom-Bi-Nator typifies machines that are midway between mixers and grinders. It contains a number of toothed rotors and stators on a horizontal shaft rotating at high speed. Feed slurry is pumped between successive plates under considerable pressure. The combination of intense mechanical and hydraulic shear effectively disperses solids into the liquid carrier.

The Szegvari Attritor makes colloidal and near-colloidal dispersions. In it a high-speed vertical agitator, operating in a closed tank, stirs up recirculated slurry. The usual colloid mill also reduces by attrition.

Size-reduction machines, of whatever design, could not do the jobs they do without the help of accessory equipment. Detailed descriptions of the accessories are given by Riegel.⁷ They include screens and air classifiers for separating dry particles; elutriators, drum and rake classifiers, and centrifugal classifiers for wet grinding. Magnetic separators, another accessory, aid in keeping tramp iron from entering the mill, and sometimes in removing magnetic particles from the crushed product.

Uniform continuous feed to fine-reduction mills is particularly important. Therefore, a wide variety of feeders, from simple screws to elaborate feeder-controllers, are needed accessories.

Often feed is pre-broken in a crusher feeder, usually a single-roll crusher with heavy lugs or teeth. Flotation cells and electrostatic separators find application in some size-reduction operations.

Mill
accessories

What Theorists Are Trying to Do

Perhaps the chief problem in size-reduction studies is evaluating the product and relating its characteristics to the energy input to the mill. The measurement of average particle size of well-graded, non-uniform products is not easy. Standard screens measure coarse materials, but they give a screen analysis, not a single value. And any arbitrary single value chosen as an index is open to question.

Ultrafine powders cannot be evaluated by screening, because they pass even the finest standard screen. Measurements of surface area and air permeability, or separation by sedimentation or air classification, have received much attention in studies of these products.

Finding a
criterion

In some operations, particle size is the only criterion of the product, but more often the shape of the particles is significant. Crushed rock for ballast, for example, should be cubical, not slabbed. Other products are desired as flakes, or granules, or free-flowing powders.

Because of the complexity of the problems and the number of variables involved, determinations of the grindability of a material are almost entirely empirical. In crushing rock, the impact resistance has been found to be the best measure of crushability rather than compression strength. Ball-mill feeds are evaluated by batchwise grinding until a certain fraction, say 85 percent, passes a 200-mesh screen. The time required to get this reduction is the grindability index. In other fine grinders, almost the only way to predict capacities or power requirements is by pilot plant or full-scale tests.

Grindability, grinding energy, and mill efficiency are all related. It takes energy to lift a

particle, to change its velocity, and to break it. All size reduction of solids, by whatever means, starts with an initial crack which spreads through and across the particle by the flow of resident energy to the crack tips.

Unfortunately, the old Rittinger and Kick theories of grinding energy did not properly take this fact into account. Rittinger said that useful work done is directly proportional to the new surface area produced and inversely proportional to the product diameter. Kick's theory, based primarily on the stress-strain characteristics of cubes under compression, states that the work done is proportional to the reduction in volume of the particles.

Need new
theories

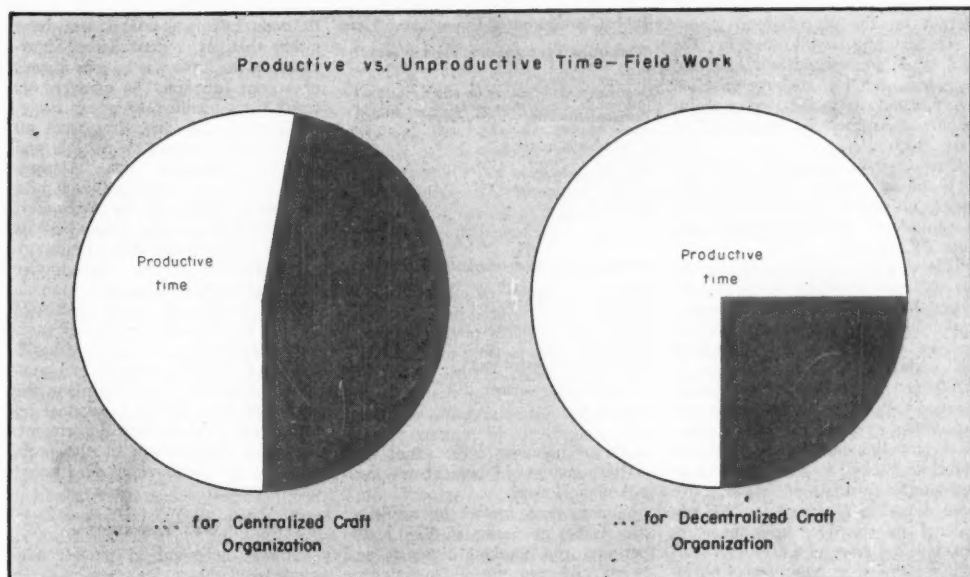
Very recently, F. C. Bond proposed a new grinding theory which concludes that the total work required varies inversely as the square root of the product size. He proposed formulas for work input and work index which permit much better comparison of the efficiencies of various types of size-reduction machines than was possible heretofore.⁸

The author is indebted to many individuals in the companies listed in the table, who contributed data, information, and suggestions for this report.

Thanks

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HOW CALCO STREAMLINED . . .

Chemical Plant Maintenance

Here's what they did to up the productive time of their men doing field work from 54 to 74 percent—and the know-how of effective scheduling, optimum backlog of work, etc. that they developed and proved successful.

STUART WHITEHEAD

In the eyes of management, plant maintenance has always been regarded as a non-productive expense. It is no wonder, therefore, in these days of rising costs, higher corporation taxes, and the growing scarcity of skilled mechanics, that management is seeking as never before new ways to cut maintenance costs.

While the experience of no one plant can serve as a model for all others, there are certain fundamentals painfully evolved by experience and proven by successful application that can be applied to chemical plant main-

tenance generally. The principles, when resolved into their elements, are basically combinations of labor and material producing maintenance work. In this article, we will be primarily concerned with the area in which the greatest savings can be made in maintenance, namely the effective utilization of maintenance manpower.

DEVELOPING A GUIDEPOST

The way to substantial savings in maintenance costs at Bound Brook has been clearly indicated by a complete analysis of the total work-load. Before you can realize substantial labor savings it is necessary that this be done under any condition. Such a study must include a complete analysis which will give you the answers to the following questions: (1) Total quantity of work. (2) Geographic location of this work. (3) Craft breakdown of the work. (4) Nature of the

work—routine, planned, breakdown. (5) Shop or field work. (6) Unproductive time. (7) Historical patterns or trends.

The work must be tabulated in such a manner as to show the intake as well as the backlog and satisfy the seven classifications. From this data the work-load in buildings in sections of the plant can be determined. Organization of this data will be the signpost of what to do, with the study of unproductive time indicating how the productivity of your hourly men can be increased.

Purpose of these studies will be to keep the craftsmen working at their skilled craft as much of their day as possible. Our actual comparative studies based on a centralized craft field work as compared to a decentralized area organization, show the total productive time of the first group as 53.7 percent against 74.4

STUART WHITEHEAD, general superintendent of the maintenance and construction dept. at Calco Chemical Division's (American Cyanamid Co.) Bound Brook, N. J. plant, is personally responsible for much of the constructive revamping of maintenance procedures described in this article.

percent for the decentralized group.

(Outstanding authorities in the field of motion study and scientific management tell us that the effective use of manpower in the average maintenance department is 60 percent of a day work rate.)

Our analysis showed procuring tools and materials to account for the largest amount of unproductive time in centralized crafts performing field work (Table I).

Due to plant expansion our central maintenance building is being removed further from the maintenance work-load center of the plant. Seventy percent of the operating buildings fall within a walking distance of 1,200 ft. from the central maintenance building. The tool room and maintenance stockroom are located in the maintenance building. This is not close enough to the field work as the comparative data on unproductive time shows 10.84 percent for the centralized crafts working from our maintenance building, against 5.75 percent for the decentralized area organization, or a potential savings of 5.09 percent by having localized craftsmen adequately equipped with most of their hand and power tools and a good percentage of their material.

Waiting for crafts was the second largest amount of unproductive time in centralized crafts performing field work. Two primary causes of unproductive time amounting to 9.10 percent were: first, the large geographic area the mechanics and craft supervisors had to cover, and secondly the duplication of supervision necessary on multiple craft jobs. Craft supervision was given jobs rather than job supervision. Adequate supervision and coordination could not be achieved on the field work. We were attempting to supervise 26 welders and 8 welder helpers with 2 first line supervisors. Delays were experienced, tempers were lost, and the welding supervisors were unhappy with the situation as the work was not being done properly.

The third area of unproductive time in these studies was recognized on observing the central craftsmen who were idle while other craftsmen were performing work. This condition was not present when observing the decentralized group. A great amount of the field maintenance work is composed of two crafts—millwright and pipefitting. Established by tradition was a group of mechanics who had broad experience enabling them to do a first class grade of both pipefitting and millwright work. With these men in the decentralized group ca-

Table I—Breakdown of Unproductive Time

Centralized Crafts Doing Field Work		%
Procure tools-matls.		10.84
Coordination of other crafts		9.10
Idle while other men work		9.0
Personal-smoking		6.6
Miscellaneous		6.4
Plan job-est. matls.	}	4.36
Production delay		
Wait-flame test		
Wait-ticket signer		
Error in job		
Truck delay		
Total		46.3
Decentralized Area Organization		
		%
Personal-smoking		7.2
Procure tools-matls.		5.75
Miscellaneous		4.72
Clarify job assignment		2.77
Clean up		2.45
Extended lunch period	}	2.71
Wait for production tool		
Late morning start— wait for assignment		
Total		25.6

pable of handling both major field crafts, a savings of 9 percent was possible on field work.

Commenting further on results of the studies as shown in Fig. 1, the personal and smoking time, as well as miscellaneous, are all unproductive time recognized by management. They represent smoking periods, medical trips and examinations, trips to the insurance department, etc.

A secondary benefit of these studies was a change in thinking towards the location of centralized crafts. Riggers, masons, and laborers (which are maintained as a centralized craft function) were spending unproductive time primarily due to travel as a result of their poor location in regard to the center of the plant maintenance workload. It was indicated that these craft shops should be moved closer to the maintenance work-load center.

LOCATING MEN AT SITE OF WORK

These studies indicated that substantial savings could be made by locating more of our craftsmen in maintenance areas. To augment the 125 men in the areas, our analysis showed that electricians, millwrights, pipefitters, welders, instrument mechanics, painters, carpenters, and lead burners should be added to each area organization. The areas were designed with a sufficient number of these craftsmen for the field maintenance work.

The pipe shop, which was a large centralized function, was completely decentralized and the supervision of the pipe machines was placed under the millwright shop foreman. Since approximately 200 men were involved in this decentralization, we felt it was easier to do it over an extended period of time. Major portion of it was accomplished in two years. Supervision was trained to handle these decen-

tralized craftsmen on an area basis rather than on a craft basis. Supervision in the areas was by jobs instead of a craft function. As many as six crafts were handled by a supervisor.

Geographically the areas were set up to be as compact as possible and cover a minimum area. Approximately 36 men composed each area and were supervised by three first line supervisors. The basic benefits to the company resulted in substantial reductions in the unproductive time and a rapid raising of the morale of the craftsmen, with increased interest in their job. Instead of working a day or part of a day in a building and then being assigned to a completely different part of the plant, the craftsmen were taking a personal interest and pride in their department. A deeper appreciation of the problems of the production department also followed.

SETTING UP AREA WORKSHOPS

It was necessary to provide adequate work space for these men in the already crowded production areas. This is being done by the construction of area workshops. One square foot of such maintenance workshops is required per 100 sq. ft. of operating building. A 40 × 60 shop is adequate for approximately 36 to 40 such field maintenance men. The shops are equipped with a drill press, hacksaw, 2 in. pipe machine, 14 in. and 6 in. grinders, and 7 work benches. For the welders, a small portable 200 amp. welding machine and cutting equipment are supplied. There are plenty of cabinets for miscellaneous instrument and electrical parts, also for the equipment and supplies for the oiler and the painter.

The work benches were designed so that individual drawers will hold the mechanics' tools. A drawer is assigned to each man and he supplies his lock, thus saving valuable floor space which would normally be taken up with bulky boxes.

A 20 × 20 stockroom is located in one corner and all the commonly used items of low monetary value are stocked here. It is based on the self-service principle which permits the men to go in and help themselves. The stock is replenished from the centralized stockroom. It costs more to procure, issue, and account for the many small items than the items are worth. No records are kept.

SELECTING SUPERVISORS

It was necessary to carefully study our supervisory organization. Job specifications were clearly defined

stating the scope of activity, the duties and responsibilities, as well as the authorities which we hoped to achieve at all levels in the department. By using the conference method we had developed such specifications for all supervisors. The upper levels of maintenance held conferences with each corresponding level until all supervisors clearly understood our specifications and their changes in duties and responsibilities under the new organization.

Upon close examination it became clear that our system for selecting supervisors lacked clarity and was not based on factual information. We had been making supervisors based on what we knew of the top hourly men in the crafts in which these supervisors were needed. We were faced with the challenge of doing a better job as we realized that we could not be completely fair or objective about such selections. We did not know all we wanted to know about our hourly people and the standards for selections varied with the people making the selections.

After considerable study we decided to develop a pre-foreman selection test which could be given to all top grade men in the department. Such a series of tests were developed which gave equal opportunity to all men in our department consisting primarily of four sub-headings—self description inventory, general classification, personal interview and general craft knowledge. Potential supervisors were screened by this series of tests and selections made on the basis of those receiving the highest mark. Experience has proven that the supervisors made from this factual approach are superior to those selected under the old hunt and pick system.

The ratio of field supervisors to hourly men is proper at 1 to 12 when geographically the supervisor's activities are restricted to one, or at the most two adjacent buildings. If the area of operation of the supervisor is increased, the ratio can go down to 1 to 8.

It was recognized early that additional technical help in the form of trained engineers was needed to properly perform maintenance work. Some knowledge of a number of fields in engineering is required. This knowledge need not be in the line supervisor's head, but trained engineers are required to aid in some of the decisions necessary in the performance of maintenance work. By this it is not construed that the maintenance department will take over the duties of the plant engineering

group. But improvements were indicated in techniques and equipment which are strictly maintenance functions; also recommendations which would reduce maintenance costs by reducing the frequency of occurrence of jobs and in some cases eliminating them entirely. We have secured some of the necessary engineering talent and they are being trained to supply engineering skill required.

PROVIDING ADEQUATE TRANSPORTATION

By locating the men at the site of the work, the nature of our transportation problem changed. However, the need for such a department was intensified by this move. It was decided to set up a transportation department whose underlying philosophy was to provide speedy transportation service to all groups in the maintenance department, both centralized and decentralized, and at the same time operate with maximum simplicity. It was necessary to reduce walking time and delays in securing material and tools for all crafts and increase the time the mechanics could spend exercising their skills in the performance of maintenance and construction work.

The organization consists of one supervisor who also acts in the capacity of a dispatcher, seven truck drivers, and one clerk. The equipment consists of a dump truck—1½ tons, a pickup truck—½ ton, a closed panel delivery truck—¾ ton, two tail gate lift stake body trucks—1½ tons, two stake body trucks—1½ tons, two trailers, and miscellaneous hand trucks, hand lift trucks, pallets, etc.

An established schedule for the delivery of hourly men to the job sites is followed by three of these trucks every morning in order to reduce walking time. The trucks have established times when they will leave certain spots in the plant and follow predetermined delivery routes. The reverse procedure is true at the lunch period when the men are picked up and brought to their eating locations. They are delivered again after lunch and picked up finally in the evening at the end of their work day. The first duty of our transportation department is the transportation of men throughout the plant, which also includes the delivery of men to specific jobs which are not included in the regular scheduled runs.

The movement of materials to job sites, area stockrooms, construction jobs, laboratories, and offices is the second function of this group. An area supervisor requiring material not presently stocked in his area simply

calls the supervisor of transportation and gives him the order number and the quantity, as well as the size of the material he wants. The supervisor of transportation writes out the stores order and directs the delivery of the material after the transportation driver has secured it from the stockroom to the area requiring it.

The third major use of our transportation department is in the delivery of equipment such as compressors, pumps, tools, and welding machines to the job site, in most cases prior to the time work is to be started. A move order for this equipment is given to the transportation supervisor who sees that the equipment is transported to the spot.

In the case of the compressors and welding machines, it is not unusual for a truck driver to start work an hour early in the morning in order to have the compressors and welding machines on the job site at the time the welders or laborers report to work. While premium time is paid for extra hour to the truck driver, savings are realized by reducing the delays of larger groups.

The volume of work which our transportation department handles, based on a twenty-day month, can be seen by the following figures: (1) 4,960 man moves on regular schedule, (2) 3,765 moves of men, equipment, and materials to and from job sites, (3) 3,933 material moves from stock to job site, (4) 3,340 deliveries of office and laboratory supplies, (5) 4,480 deliveries of supplies to production departments (not including raw materials), and (6) 480 miscellaneous deliveries.

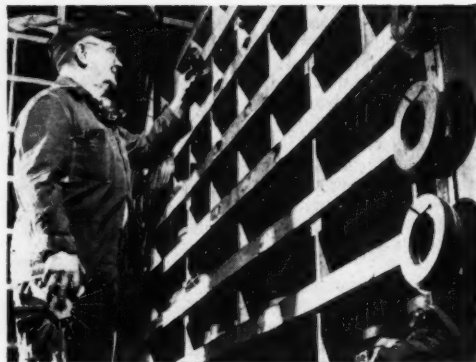
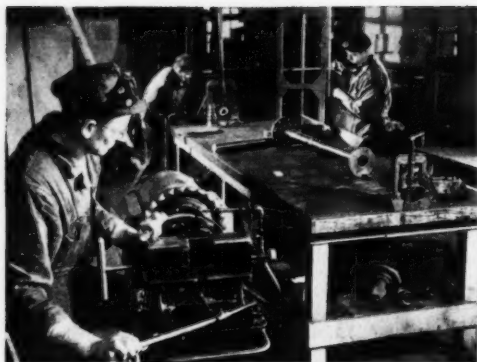
The transportation supervisor reports to the head of the scheduling department. Organizational-wise this has proved a very sound arrangement.

To minimize the cost of transportation, one truck driver loads, transports, and unloads his specific truck. To do this safely, particularly when handling heavier materials, several of the trucks are equipped with tail gate lifts and hand pallet trucks. Heavier materials can be handled on pallets or other small hand trucks from the loading platforms to the tail gate lift where the truck does the work of elevating the material to the elevation of the truck bed.

We have achieved simplicity of organization, speedy service, and maximum coverage in our small transportation department.

SCHEDULING OF MAINTENANCE WORK

With the development of the decentralized areas and the transporta-



An area shop. At right, stockroom from which all commonly-used items of low value are taken as needed on the self-service basis.

tion department, the need for scheduling of maintenance work was brought sharply into focus. To us, scheduling is an organized way of performing maintenance work. Its benefits are many, but primarily we were guided by the fact that maintenance work could be done cheaper.

All maintenance work must be requested by written orders. These orders must be pre-estimated by man hours per craft. They must be collected at a common point, which is the scheduling department, and the system of scheduling must be simple, easy to administrate, and is by its nature a staff function. We have a modified scheduling system with participation in this function enjoyed by every craft in the department.

The operating department initiates all maintenance orders in writing to the area supervisors and indicates the relative priorities of this work. The area supervisors in turn determine the work content by estimating the jobs by main hours and crafts, considering such things as shop shutdown dates, the relative job priority indicated, current area work load, and makes a decision as to whether the area personnel will perform this work or if it will be passed on to scheduling to be done by the central craft group. The area supervisor makes up and maintains the schedule for the personnel in their areas. This is done on a weekly basis and it is guided by the priorities of the production department and influenced by the breakdowns and other job interruptions.

Work which requires the services of the central craft shop is handled as follows:

(1) Each area supervisor prepares a list of the most important jobs in his area from the information supplied by the operating department.

(2) He indicates relative impor-

ance of each job, numbering them 1, 2, 3, etc.

(3) These priority lists are used by the scheduling department to prepare basic craft schedules within the limits of available manpower.

(4) Schedules and job cards are issued to the crafts executing the work. Each job card bears the composite priority number in red.

(5) The crafts execute the work on the basis of the priority indicated and the availability of the job.

Should the plans of a craft change during the week for which the schedule is issued and they cannot do one of the jobs as planned, or conversely they complete the work planned and required additional jobs to fill out the week, they contact the scheduling department and additional jobs are issued to them from the list submitted by the areas.

Experience has taught us that the nature of the work performed by central craft groups adapts itself with varying degree to scheduling. With the riggers, for example, approximately 45 percent of the work can be scheduled on the weekly basis, while with such crafts as the sheet metal shop, 80 percent of the work can be scheduled. Within these ranges, the work the scheduling department transmits on the weekly schedule to the crafts will be completed. The craft supervisors, however, are charged with the responsibility of working their particular crews effectively and are given the opportunity to coordinate their scheduled work with those of other crafts in the shops and in the field. This basic principle simplifies the scheduling problem in a plant such as ours where a large number of craft activities must be coordinated.

When breakdowns occur which necessitate interruptions of the schedules, requests for such interruptions

pass through the next higher level of supervision above the area head. He in turn contacts the scheduling department telling them at what point to fit the new job into the schedule and in some cases what job to delete. Normally the job deleted is the lowest priority job issued for that week.

The construction department, which is a section of the maintenance department, uses scheduling in the same manner as outlined for maintenance work. Priorities on construction work are normally set up by top management and scheduling of work starts upon receipt of complete engineering information and materials.

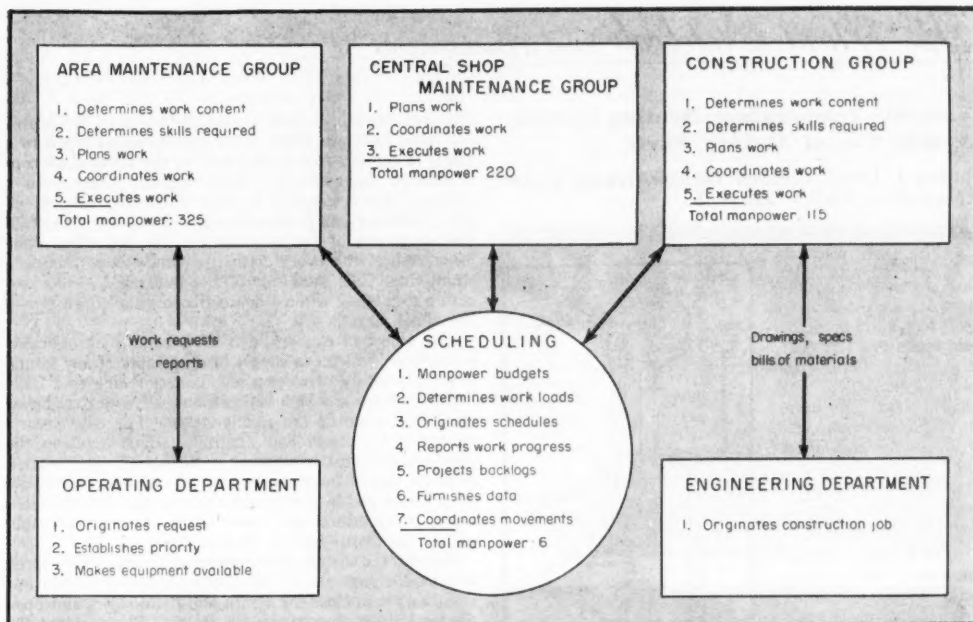
Tabulating equipment is used to obtain statistical data such as backlog information and consumed hours per craft and per area, etc.

Our scheduling department accomplishes two objectives: (1) It transmits a commonly understood signal of job importance, as indicated by the operating department, to each craft or group performing maintenance work. (2) It insures that the work is done in the order of importance within the limits of the fixed manpower available.

The complete scheduling organization is composed of a supervisor and five people.

DETERMINING HOW LARGE A BACKLOG

After the installation of scheduling, the question immediately arose as to how large a backlog should be maintained. The answer to this depends upon a number of factors and can be answered by discussing the limits which influence the effectiveness of the department. Minimum economical backlog should not be less than ten crew days for each craft or area. Problems of planning, procurement of material, arranging shutdowns, coordinating of crafts, and making a physical schedule indicates that a



Scheduling setup at Bound Brook. Main reason for scheduling: maintenance work could be done cheaper using a simple system.

lesser backlog is not practical. In some crafts a backlog as large as fifty crew days is possible without interrupting production or impairing the general state of maintenance in the plant. The amount of backlog the department has is dictated primarily by company policy. However, it is my opinion that for the best functioning of the maintenance department a fourteen to eighteen crew day backlog is desired.

PROVIDING FLUIDITY OF WORK FORCE

The typical area organization is composed of the following personnel: area head, 1 work coordinator, 3 crew chiefs (first line supervisors), and 36 mechanics.

The basic breakdown of crafts is as follows: 17 area mechanics (combination millwright and pipefitting), 2 instrument mechanics, 1 pump man, 2 electricians, 1 leadburner, 1 welder, 1 carpenter, 3 painters, 2 brush hands, 4 helpers, 1 pipe coverer, and 1 oiler.

Due to the variance of work-loads in the respective areas it is necessary to adjust daily our forces in the field to meet a high demand placed on us in a particular area. If the demand can be met by the addition of one or two men, the work coordinator will contact other areas and request additional help. If he fails to get assistance or requires more than two men to meet the increased work load

he contacts his immediate supervisor, who is the area head, and arrangements are made through the area head supervisor for the additional crews. These additional men may come from another area or from a small reservoir of men regularly working in central craft or from construction. Regardless of where the men are obtained, coordination of work is maintained as an area function of the area supervisor and whether the men are loaned from central craft or from another area, they become temporary members of the area in which they perform the work. For this system to operate properly it is essential that communication be prompt, complete, and factual. The supervision thus making an honest evaluation of the situation must make every effort to help themselves before requesting work from other groups.

If the central craft group has a high work-load it is possible to adjust our forces to reduce materially the pressure developed by this concentration. Manpower can be drawn from either the area organization or the construction organization, work can be contracted, or as a last alternative, longer hours or more men may be added.

A situation of high work-load recently developed in the sheet metal shop. The first approach to such a problem was to review the work to

determine what substitute material could be used which would involve the use of other crafts. The carpenter work load was bolstered by the removal of a number of sheet metal duct jobs and the material specifications changed from sheet metal to square ducts made of specially treated plywood lined with acid proof cement. The sheet metal backlog was reduced by work performed by carpenters and masons. The construction requirements for sheet metal work were reduced and this resulted in more men available for maintenance work. The situation was remedied without the addition of new personnel to our department.

Should the construction department be given high priority on a job requiring specific crafts and the date is one which we cannot meet with the present crews, their first call is to the central craft group and secondly to the area organization. Peaks of a temporary nature consequently are met.

Complete flexibility of the total force in the department permits a free flow of the available manpower to construction jobs, field work, or shop jobs as situations develop which require additional man hours or specific jobs. In this manner the maximum utility of our manpower forces are obtained.

Variable-Temperature Heating System Avoids Use of Moving Parts

JOSEPH I. LACEY, Chemical Engineer, Hooker Electrochemical Co., Niagara Falls, N. Y.

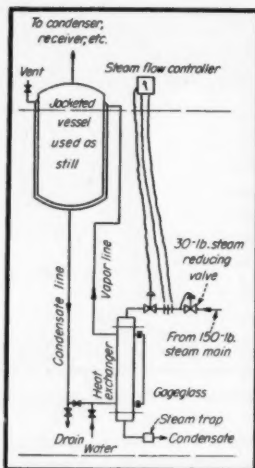
★June Contest Prize Winner

Some time ago we had a variable-temperature heating problem as part of a hurry-up process expansion. As outlined below, the system we adopted was installed and has been operating very successfully since it was started up. Its simplicity and lack of moving parts makes it very popular with the operating men.

The Problem—It was necessary to develop and install a heating system for a jacketed vessel. This vessel was to be used to vacuum distill a volatile solvent from a liquid product that is somewhat heat sensitive. Available information indicated that a pot temperature of 80-100 deg. C. might be required. It was clear that, the lower the jacket temperature, the less would be the decomposition, and the slower the distillation rate. Therefore, it was necessary to devise some easy method of varying the jacket temperature so that the optimum operating conditions could be found.

The Solution—The accompanying sketch shows the type of system adopted. It is a closed-circuit steam heating system to which heat is provided indirectly by live steam supplied to the tubes of a vertical shell-and-tube heat exchanger. The heat exchanger acts as a boiler, producing steam from water contained in the closed system, at any desired pressure from sub-atmospheric to a pressure not much below that of the supply steam.

The exchanger is installed vertically below the jacketed



still, with the upper shell connection piped to the top of the vessel jacket, and the jacket bottom outlet piped to a drain, to a water supply line, and to the lower shell connection of the exchanger. High pressure steam from a 150-psig. line is supplied through a reducing valve at 30 psig., passing through an orifice and flow control valve to the upper end of the tube side of the exchanger. The lower end of the tubes discharges condensate through a steam trap. The shell side of the exchanger is provided with a gage glass, while a vent valve is installed on top of the vessel jacket.

The object of this set-up is to provide a steam-heated water boiler which can supply heating vapor at any saturation temperature between a low, corresponding to a fairly high vacuum, and a high which is only a few degrees below the temperature of the supply steam. The only control needed is the steam flow controller which regulates the rate at which heat is supplied to the boiler. The relation between rate of heat supply, and rate of heat withdrawal by radiation and by heat transfer to the still contents determines the pressure and hence the temperature of vapor within the closed heating system.

To put the system into operation initially it is necessary to discharge the air fairly completely. A simple way to do this is to close the return and drain valves and open the vent valve, then run water in until it comes out the vent. Water is then shut off, the vent valve is closed, and high-pressure steam is put into the heat exchanger tubes at maximum rate, with the drain valve open. Water boils in the shell side of the exchanger, builds up pressure, and forces liquid water out through the drain. This is continued until the gage glass shows the heat exchanger shell side to be about two-thirds full. Steam is shut off and the valves set in normal operating position. This operation exhausts most of the air and if the system is reasonably vacuum-tight, need not be repeated often. An occasional check of jacket temperature vs. pressure of the vapor will indicate when another purge is necessary.

During normal operation the water level of the closed system should be about two-thirds on the gage glass when the system is cold. When live steam is put into the heat exchanger through the flow controller, water will vaporize on the shell side, building up in pressure and corresponding saturation temperature of the vapor. Vapor will flow upward to the vessel jacket and there condense, transferring heat to the vessel contents. Obviously, transfer of heat to the liquid in the vessel will depend both on the vessel conditions and on the temperature of vapor in the

★July Contest Prize Winner

"Design for Radiocobalt Liquid Level Gage for Closed Process Vessels."

A prize of \$50 in cash will be awarded to Stanley L. Eisler, radiochemist at the Rock Island Arsenal Laboratory, Rock Island, Ill. Mr. Eisler's article will appear in the September issue.

\$50 PRIZE FOR A GOOD IDEA—Until further notice the Editors of *Chemical Engineering*, will award \$50 cash each

month to the author of the best short article received that month and accepted for publication in the *Plant Notebook*. Each month's winner will be announced the following month and published the second following month.

\$100 ANNUAL PRIZE—At the end of each year the monthly winners will be rejudged to determine the year's best *Plant Notebook* article, which will then be awarded an additional \$100 prize.

HOW TO ENTER CONTEST—Any reader of *Chemical Engineering*, other than

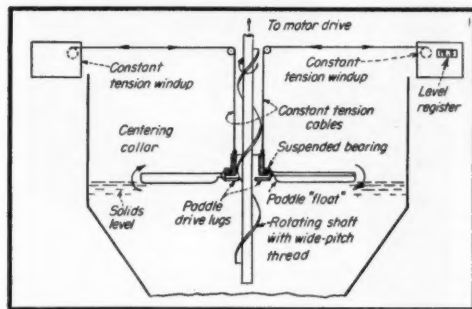
a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 500 words, but illustrated if possible. Articles which are acceptable but are not winners will be published at regular space rates (\$10 minimum).

Articles may deal with plant or production "kinks," or novel means of presenting useful data, which will interest chemical engineers. Address *Plant Notebook* Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.

jacket. But for any given set of vessel conditions, such as height, character and agitation of contents, the rate of heat transfer will depend on the vapor temperature alone. But for any given steam supply to the heat exchanger, only so many Btu. per min. will be available for transfer from the vapor to the vessel contents. Therefore, the jacket pressure and temperature will adjust themselves automatically to transfer just as much heat as is supplied—neglecting radiation. More live steam supplied to the exchanger through the flow controller will thus raise the vapor temperature and pressure and transfer more heat, while less supply steam will have the reverse effect. In any event, the jacket temperature will be the lowest that can give the rate of heat transfer needed to produce the desired distillation rate.

At the end of distillation if the live steam is left on, there will be very little transfer of heat to the empty vessel and the temperature and pressure of the vapor will approach those of the live steam. At that point, heat transfer in the exchanger will virtually cease and the flow of live steam will fall below the set point, just making up for radiation losses.

During operation the live steam condenses and condensate leaves through the trap. Vapor condenses in the vessel jacket and its condensate returns to replenish the water supply in the shell side of the exchanger. Thus, except for air in-leakage into the vapor system when it is cold, or operating at sub-atmospheric pressure, or possible vapor losses when operating at pressures above atmospheric, there are no changes in the closed heating system that require operating attention. A possible refinement that would still further decrease the need for attention would be to tie a pressure controller on the vessel jacket into the live steam flow control.



Paddle "Float" Measures Solids Level Continuously

JOHN F. SCHNACKY, Chemical Engineer, Buffalo 22, N. Y.

Sketched above is a device for continuously measuring solids level in bins. It can be built to be safe in dust-explosive atmospheres and to be proof against clogging with dust. If properly sized and weighted, it can be used to level the bin contents continuously as it measures the instantaneous level.

The fundamental idea is simple. A continuously rotating vertical shaft carries a steep-pitched thread which drives a pair of paddles supported on ball bearings from a counterbalanced race. The counterbalancing, by means of cables connected to two constant tension windups, is not quite sufficient to support the weight of the paddle "float"

assembly. Hence the rotating "float" sinks until the paddles contact the top of the solids. The resistance to rotation so introduced causes the "float" to climb the screw until it reaches a balance point at which light contact with the solids just supplies the amount of support not provided by the windups. One windup drives a level register which continuously shows the level at which the "float" is riding. The range of this instrument is limited only by the length of shaft that can be used.



Neoprene Paper Solves a Problem In Drying of Dyestuffs

At its Chambers Works, Deepwater Point, N. J., Du Pont has adopted a practice which greatly simplifies the drying of dyestuff pastes in stainless steel dryer pans, and saves in the order of \$5,000 per year. This consists in lining the bottom of the pans with a sheet of neoprene-containing paper which largely eliminates any tendency for the dried dyestuff to adhere to either the pan or the paper. The same trick is now being used also in certain other cases where sticking is not involved because the paper liners are cheap, and insure that the color will be resting on a clean surface. At the same time, the pans are kept clean.

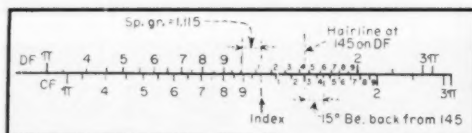
The paper used is Netone 2, a 60-lb. unbleached kraft containing 2 percent neoprene which is made by Claremont Paper Co. The sheet is cut to the inside dimensions of the pan and held in place by dabbing a spot of neoprene latex at the four corners. Formerly scotch tape was used to hold it. The application, in use for the last two years, was developed by Granville Maddox, veteran general foreman who is shown at the left, demonstrating it in the upper view. An idea of the sticking qualities of the

paste when dried in a bare pan can be gained from the pan at the right. In the lower view, operator Charley Robinson, long-time sparring partner of Jersey Joe Wolcott, shows how easy it is to load a lined pan from the nutsch filter, prior to putting it in the portable dryer rack at the left.

The problem solved by this paper was one of long standing. Polythene sheet, plain kraft, 12 or 15 kinds of special papers impregnated or coated with silicone or other resins, all failed because the paste stuck. Brushed-on silicone coatings would work for only two or three batches. But the neoprene paper need not be replaced for the duration of a campaign on whatever color is being run, which may amount to as much as two or three weeks.

Air Blast Spots Empties

David Schreiber, plant superintendent at the Buffalo, N. Y., pharmaceutical plant of the Amer Co., has worked out a very simple solution to the problem of "empties," that is, cartons accidentally sealed without their intended load of bottled drugs. He installed an air blast directed at the cartons coming off the discharge belt of the automatic sealing machine. Pressure is strong enough to blow off the empty cartons, without disturbing the filled ones.



Easy Baume-Specific Gravity Conversion With Slide Rule

R. S. Cook, Chemical Engineer, Zaremba Co., Buffalo 2, N. Y.

In his recent article on Baumé-specific gravity conversion by means of the log-log slide rule Davis (*Chem. Eng.*, p. 171, Mar. 1952) stated that the ordinary conversion equation is not well adapted to slide rule use. He therefore advocated an approximate method based on properties of the log-log scales.

Actually, there is a simple method of using the A and B, C and D or CF and DF scales which employs the well known conversion formula:

$$\text{Specific gravity} = \frac{145}{145 - \text{deg. Bé.}}$$

and so gives results as accurately as they can be read on a slide rule. Fundamentally, the method merely solves the equation, but it does it in a way that makes it easy to remember.

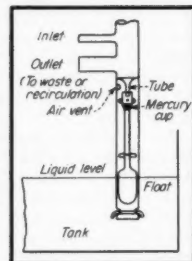
The folded DF and CF scales are best if a rule having them is available, but the A and B or C and D scales can be used in the same way and almost as easily. Set the hairline on the runner to 145 on the DF scale and set the slide with the indexes on CF coinciding with those on DF. This is the starting point, or 0 Bé. = sp. gr. 1. Then move the slide to the right, counting off the deg. Bé. on CF as they pass under the hairline. Since 145 on CF represents 0 Bé., then 140 on CF represents 5 Bé., 130 represents 15 Bé., 95 represents 50 Bé., etc. It is obvious that this is simply a case of subtraction of deg. Bé. from 145, as in the denominator of the expression above.

At any position of CF corresponding to a particular

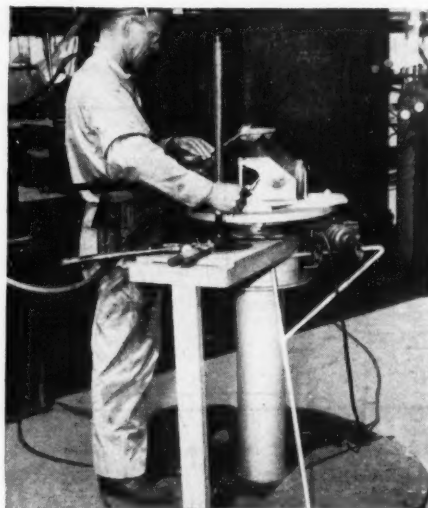
number of deg. Bé., the corresponding specific gravity is then found over the CF index on the DF scale. Conversely, when the CF index is under any value of specific gravity, the distance from the hairline to 145 on CF gives the corresponding deg. Bé.

Simple Device Holds Tank Level

Two National Bureau of Standards men, D. E. Couch and Abner Brenner, have recently developed a simple level-control valve adaptable to either laboratory or large-scale equipment. The glass lab model shown can easily be reproduced from standard pipe fittings for plant use. An open-bottom cylinder extending down into the tank contains a float carrying a small mercury cup at the top.

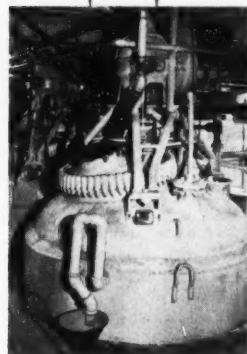
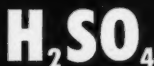


Above the cylinder and connected to it only by a tube which dips into the mercury cup is a liquid supply and overflow. When the tank level is at the right height the float rises and the mercury seals the tube, causing liquid entering the inlet to overflow to waste or recirculation from the outlet. If the tank level falls, the float drops, unseals the tube and allows liquid to enter the tank by overflowing the mercury cup.

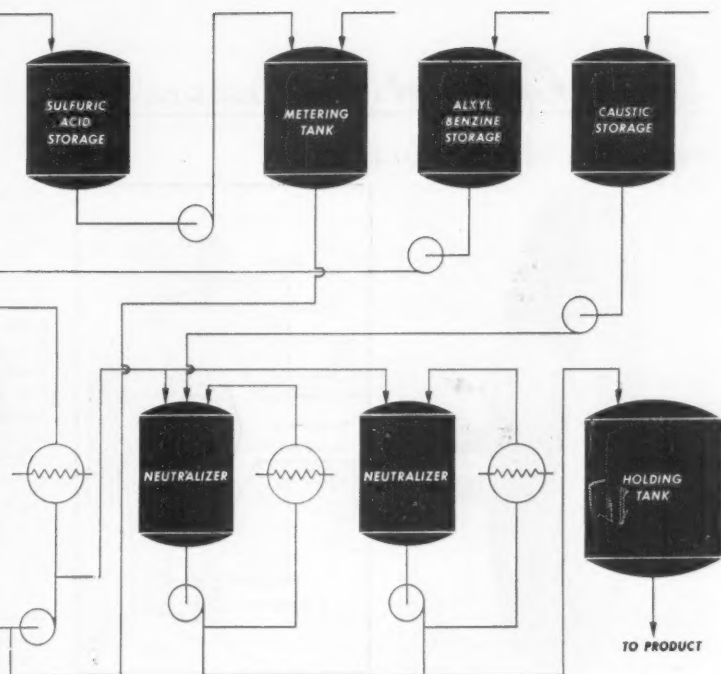


Machine Reclaims Weld Ells

Pictured above is Harvey T. Dennis, welder at General Petroleum Corp.'s Torrance, Calif., refinery, shown using the machine he devised from scrap parts for reclaiming scrap weld ells. To reclaim such fittings by hand when the attached tubes wear out has proved too expensive. Therefore, Dennis devised his machine with a rotating table, stationary cutting torch, and clamp for holding the ell. The tube is first cut roughly from the ell by hand torch. Then the ell is mounted on the table and the torch used to produce a clean scarfed end, ready for subsequent re-use.



SULFONATOR



If you process with H_2SO_4 , you need the corrosion resistance of glass plus the working strength of steel

For across-the-board resistance to corrosion by sulfuric acid, glassed steel is *the only completely suitable material of construction* available today. Glassed steel is fully resistant to dilute solutions up to the boiling point and to concentrated solutions at temperatures up to 450°F. It is equally inert in the critical range of 60-96% concentration of H_2SO_4 . It is not attacked by fuming sulfuric acid (oleum) and its corrosion resistance is not affected by aeration, velocity, impurities, or the use of mixed acid. No inhibitor is ever required.

For these reasons, glassed steel equipment has virtually unlimited service life in processes using sulfuric acid. Further, it eliminates the possibility of contamination or undesired catalysis which may be caused by the presence of even small traces of metal in solution.

Pfaudler glassed steel is resistant to *all* acids except hydrofluoric, even at elevated temperatures and pressures. With a new Pfaudler glass, it is possible to handle not only acids but also *alkaline solutions* up to a pH of 12

and 212°F. It is now possible to perform both acid reactions and neutralizations in a single glassed steel vessel.

To give it working strength, Pfaudler glass is fused to steel in huge furnaces at temperatures of 1500-1700°F. *This high-temperature firing locks the glass to the steel and makes it hard and tough.*

Pfaudler glassed steel pressure reactors, in capacities from 5 to 3500 gallons, are commonplace in chemical processing today. These units are equipped with agitation, are usually jacketed, and are supplemented by a complete line of standard glassed steel accessories. Custom-built vessels as large as 8300 gallons, for severe chemical service, have been constructed. Glassed steel columns and evaporators solve many serious corrosion problems.

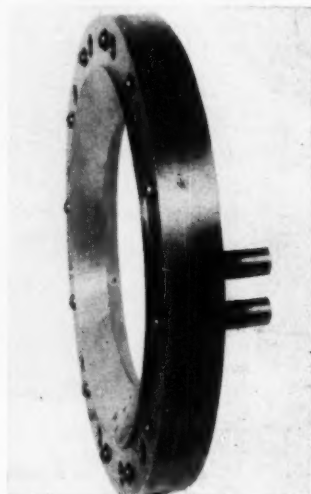
Whenever you have an equipment problem requiring *corrosion resistance, durability, and versatility*, as well as the *economy* which these features provide, look to Pfaudler glassed steel for the solution. Write for Bulletin 894-S1, our new general catalog.

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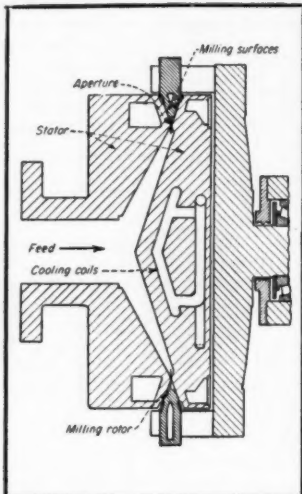
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Factories at: Rochester, N. Y.; Elyria, Ohio; Leven, Fife, Scotland; Schwetzingen-Baden, Germany

NEW PROCESSING EQUIPMENT



THIS rotor mounted ON spider rotates around stator.



New Mill Ups Dispersion

Unique mill design provides area contact between milling surfaces and material, rather than more common line contact. Result is better milling at lower cost.

Practical realization of area contact milling is found in the new Filmill. Large milling area is obtained by having a circular ring, with wedge shaped inner periphery, rotate in a stationary, wedge-shaped channel. Material being processed is force-fed through annular slot at bottom of channel.

Initial production testing of this mill is said to indicate performance superior to that of conventional roller mills and mixers for stiff pastes or doughs. Original investment and power costs are lower per unit of material milled. Increased product refinement is secured with controlled product temperature where required.

Based on performance evaluations to date this equipment shows promise for the following broad applications:

1. Thin film homogenization of stiff solid materials to new degrees of dis-

persion and crystalline particle subdivision.

2. Thin film drying by mechanical manipulation of heat sensitive materials.

3. Thin film pulverizing by internal shear.

4. Thin film aeration and granulation at controlled density and screen size.

Pictured above is rotor which imparts milling action to material being worked. Sketch shows position of rotor with respect to stator.

Feed to milling head enters from left propelled by a slow-speed, heavy-duty gear pump. Impinging on cone-shaped deflector material slides along cone surface and through annular slot at base of cone. Material emerging from annular slot hits moving rotor and is dragged between milling surfaces. The combination of centrifugal force

and pressure of incoming feed forces material through milling gap to discharge point.

There are a number of variable adjustments on the Filmill. Feed pressures for instance can be varied up to 4,000 psi. Clearance of milling surfaces can be adjusted in a range from 0.001 to 0.015 in. Milling temperature is controlled by rate and temperature of water circulating through ducts in rotor and stator.

Rotor speed can be changed as desired. Also for granulation operations a rotor is used having radial slots in milling surface. Where feed material may tend to clog annular feed slot an orifice cleaning tooth is set into knife edge of rotor. As rotor revolves this tooth sweeps orifice preventing fouling.

Choice of construction materials for rotor and stator can be made from either hard chromium-plated phosphor bronze or chrome-nickel alloy. Plated bronze has the advantage of favorable heat transfer characteristics. Abrasion resisting chrome-nickel alloys are readily supplied because castings are designed to require only grinding as a finishing operation.

Sample operating data are furnished from milling tests on soap containing from 5 to 15 percent moisture. Power requirements were 1 hp. per 100 lb per hr. for feeding and the same amount for milling at a shearing speed of over 700 ft. per min. Mill capacity was 100 lb. per hr. per in. of milling rotor diameter.

Soap feed temperature was 90 deg. F. Operating with a shear rate of 700 ft. per min. and using 40 deg. F. cooling water the soap discharge temperature was 130 deg. F. Decreasing shear rate to 400 ft. per min. dropped the discharge temperature to 100 deg. F. — *Micro Processing Equipment, Inc., Savage, Minn.*

Slurry Mixer Uses Venturi Principle

Wetting of insoluble materials to produce slurries is now readily accomplished, using a slurry mixer based

Equipment Cost Indexes

(Marshall and Stevens Indexes of Comparative Equipment Costs, 1926 = 100)

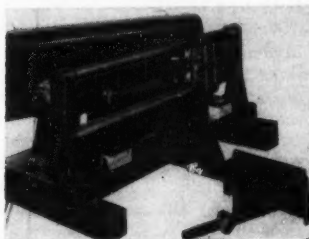
Industry	June 1951	Mar. 1952	June 1952
Average of all	180.9	180.2	180.3
Process Industries			
Cement mfg.	173.1	172.8	172.6
Chemical	181.1	180.8	181.0
Clay products	168.1	167.8	167.6
Glass mfg.	171.2	170.9	170.7
Paint mfg.	174.4	174.1	174.3
Paper mfg.	174.7	174.4	174.6
Petroleum ind.	177.5	177.2	177.4
Rubber ind.	179.9	179.6	179.8
Process ind. avg.	178.5	178.2	178.4
Related Industries			
Elec. power equip.	182.7	182.4	182.6
Mining, milling	181.8	181.5	181.7
Refrigerating	200.5	200.3	200.5
Steam power	170.3	170.0	170.3

Compiled quarterly for March, June, September and December of each year by Marshall and Stevens, evaluation engineers, Chicago and Los Angeles. Indexes are prepared for 47 different industries, from which the eight process and four related industries listed here are selected. Published each month with the latest available revision. For a description of the method of obtaining the index numbers see R. W. Stevens, *Chemical Engineering*, Nov. 1947, pp. 124-6. For a listing of annual averages since 1913 see *Chemical Engineering*, Feb. 1952, p. 191.

on the venturi principle. This mixer, using no moving parts, is said to be readily adaptable to the slurrying of almost any type of solids and liquids.

A hopper feeds the powdered solid into the liquid at optimum rates and pressures predetermined by actual tests on the materials being used. Dusting is reduced by special feed hopper construction. Instant wetting of all particles is produced, creating a homogeneous mixture.

Brass construction is standard, although many other metals or alloys can be used. The unit is readily portable. Inlet and outlet openings can be fitted with either threads or flanges. —National Foam System, Inc., Union St. & Adams Ave., West Chester, Pa.



Automatic Sampler Gets Accurate Cuts

Combining the features of positive chain-and-sprocket drive and ball bear-

IN BRIEF—A capsulated listing of this month's newsworthy equipment.

Processing Equipment

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ing rollers, this automatic sampler travels either 16 or 21 in. across a wet or dry stream to obtain an accurate sample cut for control testing. A limit switch shuts off the motor at the limits of cutter travel; a time switch reactivates the mechanism according to an established sampling cycle. Cutter travel speed is fixed at 7½ in. per sec.—Denver Equipment Co., Denver, Colo.

Twin Drum Dryer Uses Novel Spray Feed

A novel twin drum dryer recently displayed at the Achema Convention at Frankfurt-am-Main, Germany aroused considerable interest among Americans attending the show. The equipment is particularly suitable for drying heat-sensitive liquids where a short drying time is required.

Drying is done on two counter-

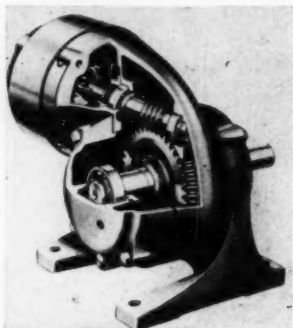
rotating heated cylinders. Liquid to be dried is fed into troughs located approximately at horizontal centerline of each roll. Mounted over each trough is a long rotating shaft carrying a number of sharp edged circular disks.

As shaft rotates the disks, which are dipping into the liquid, pick up a film which is thrown outward by centrifugal force onto sharp edges of disks. Two low-pressure air jets adjacent to each disk then project liquid in the form of a fine spray onto drying drum.

Dried material is removed by a scraper blade riding against drying drum below feed trough.

With this type of spray mechanism there is never any danger of pipe or nozzle stoppage since the liquid itself never passes through a spray nozzle. —Escher Wyss Ltd., Terminal House, 52 Grosvenor Gardens, London, S.W.1, England.

NEW ELECTRICAL & MECHANICAL EQUIPMENT



**Worm Gear Motor
Has Cantilever Mount**

Recently placed in production is a new line of low-speed right-angle worm gear motors. As may be seen in the above picture, the motor is cantilever mounted on the side of the worm gear housing. This design is said to protect gear alignment.

Gear and motor housing are free from distortion. Mounting stresses are absorbed by a rugged single-unit pyramidal base with spread eagle feet. Installation can be either horizontal or upright.

The hardened and ground worm is splash lubricated. Gear ratios up to 58:1 are available with resultant speeds ranging from 20 to 155 rpm.

Motor horsepower range from $\frac{1}{4}$ to 3 hp. Either three-phase or single-phase windings can be supplied. Where desired, splash-proof or totally enclosed design can be provided.—U. S. Electrical Motors, Inc., P. O. Box 2058, Los Angeles 54, Calif.

Automatic Alarm Spots Equipment Failure

The Tel-Alarm is a low-cost automatic alarm to signal abnormal operation or failure of valves, pumps, heaters and other kinds of equipment. The alarms are of unitized construction, permitting a great variety of circuit arrangements on one basic alarm unit. This is made possible by a switchboard circuit header which is wired into the basic relay in different ways, depending upon the circuit desired.

The alarm is approved for all Class 1, Division 2 applications. Being hermetically sealed, the units are also suitable for all general-purpose uses

because of moisture and corrosion-proof construction. Two types of signal lights are available, with either back-lighted name plates or giant turret lenses for two light systems.—Tigerman-Anderson Co., 4332 North Western Ave., Chicago, Ill.

Air Pump Oiler Assures Oil-Free Air

A new automatic oiler for Leiman air pumps is said to assure virtually oil-free air delivery. The E-113 oiler has no moving parts, feeds only when pump is running. Air draft passing through the oiler actuates oil delivery to pump.

Any oil from SAE 10 to SAE 70 can be fed by this device. Quickly adjusted rate can be varied from one drop in 4 min. to four drops in 1 min. Oil reservoir, holding three ounces, is transparent and hinged for easy refilling.—Leiman Bros., Inc., 146 Christie St., Newark 5, N. J.

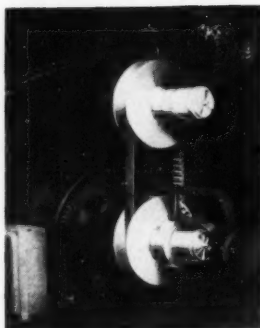
Fixture Hanger Is Explosion-Proof

Now available is an explosion-proof fixture hanger for suspending overhead explosion-proof lighting fixtures. It is said this fixture will perform the same function now handled by small junction boxes with union, nipple or canopy covers.

The Type EFHC explosion-proof hanger is essentially a tee fitting with a large circular side port located at the junction of the tee. Top of the tee provides the feed-through hub for lighting circuit conduit. Upright of the tee supports fixture stem. Removal of the threaded cover on circular side port permits easy entrance for connection of circuit and fixture wires.

An assembled fixture may be threaded into bottom hub of hanger. Once fixture is mounted on hanger, fixture and conduit wires are connected. A compact connection block is available as an alternate to a spliced connection.

Hanger is available with either plain hub or union hub for the fixture stem. Both types of hubs are provided with set screws to prevent loosening from vibration.—Crouse-Hinds Co., Syracuse 1, N. Y.



**Variable-Speed Pulley
Works on Fixed Centers**

Designed for power applications requiring maximum speed variation, the new Roto-Cone manually operated variable-pitch motor pulley, used in combination with a standard Roto-Cone variable-pitch pulley and Vari-speed belt, permits a speed-change ratio up to 9 to 1.

Speed change is accomplished by an axial adjustment of a ball-bearing mounted retainer ring fixed on the hub of the manual pulley. This causes the pulley to change pitch diameters, and since both the manual and self-adjusting pulleys are on fixed centers and the belt length remains constant, variation of one pulley automatically affects the other an inversely proportionate amount. With this device, therefore, no adjustable motor base is needed.

Models are available to handle requirements in the range from fractional to 15 hp.—Gerbing Mfg. Corp., Northbrook, Ill.

Selenium Rectifier Is Sealed In Oil

A new selenium rectifier features freedom from deterioration in corrosive atmospheres. This is because the transformer and rectifier stack are completely sealed in oil.

This rectifier is designed especially for electrolytic and electrochemical applications. It has an output of 3,000 amp. with voltage adjustable from 10 to 40 v. Dimensions are 78 in. high, 84 in. long and 29 in. deep. Other sizes in different voltage and current combinations are available.—Electronic Rectifier Co., Rochester, N. Y.

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RESULTS
before you buy!

FORMER DRYER

Installed cost\$17,800
Drying time.....24 hrs.
Drying cost.....\$0.354 per 100 lb.
(space required, 950 sq. ft.)

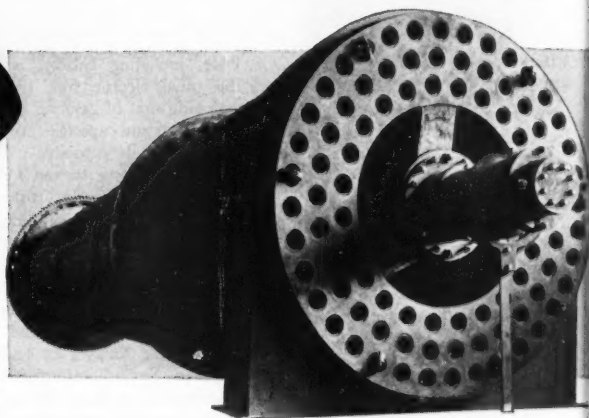
LOUISVILLE DRYER

Installed cost\$29,000
Drying and cooling time.....45 min.
Drying cost.....\$0.123 per 100 lb.
(space required, 300 sq. ft.)

YEARLY SAVINGS

IN DRYING COSTS

ALONE... \$8,300



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Contamination reduced to zero—no need for reprocessing
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If high drying costs and low drying performance are bothering you these days, call in a Louisville engineer. There is no obligation.

Ask for new treatise on subject of rotary dryers

Other General American Equipment:

Turbo-Mixers, Evaporators,
Dewaterers, Towers, Tanks, Bins,
Filters, Pressure Vessels



Louisville Drying Machinery Unit

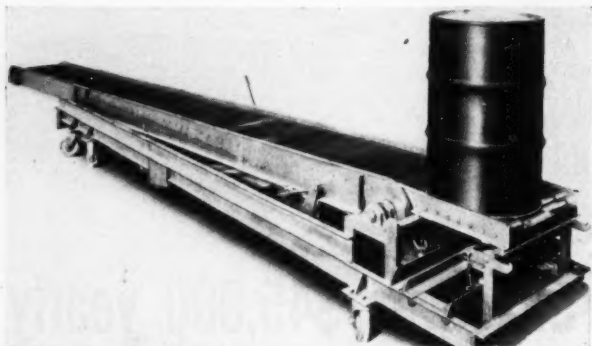
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NEW PACKAGING & HANDLING EQUIPMENT



PORTABLE POWER-DRIVEN CONVEYOR UNLOADS CARS

Unloading drums from box or gondola cars is facilitated with this new belt conveyor. Boom is raised to a maximum inclination of 11 deg. by a hydraulic lift. Belt speed is 40 ft. per min.—Alvey Conveyor Mfg. Co., 9301 Olive Street Rd., St. Louis, Mo.

Vibrating Feeder Spreads Its Discharge

A new style vibrating spreader feeder discharges a continuous curtain of such bulk materials as roofing granules, calcium chloride or salt in numerous food and chemical processes.

The Spreader Feeder is made up with a flat pan having a diagonal slot for discharge and powered by a single electromagnetic drive. The latter may be mounted either above or below the flat pan trough, depending upon the room available.

In operation, the feeder's vibratory action flows the material out along the trough, discharging it along the edge of the slot to form a constant, even curtain of material that is two to four times the width of the original material stream.

Rate of feed is controllable merely by turning the feed control knob in the separate control box until the desired feed rate is reached. The feeder is available in several sizes and capacities.—Syntron Co., 610 Lexington Ave., Homer City, Pa.

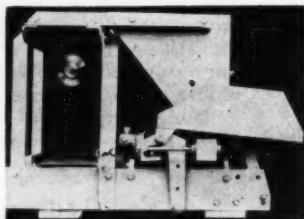
Fork Truck Has Slimmed Down Lines

The new Space Master Model J electric fork truck offers an answer to materials handling in narrow aisles and cramped areas. This line of trucks is said to weigh between one-third and one-half less than standard electric fork trucks of the same capacity rating.

Price, including battery, is one-half the usual electric fork truck price, matching that of gasoline fork trucks.

Weights and capacities are 3,200 lb. in the 1,000-lb. capacity, 3,500 lb. in the 1,500-lb. capacity, and 3,900 lb. in the 2,000-lb. capacity. Aisle requirements are 5 ft., plus load length. The steering wheel can turn at right angles to front wheels.

Among features incorporated in the new design is a single magnetic controller to handle speed and braking. Four speeds forward or reversed are provided. Smooth automatic timed acceleration through each speed to full speed is secured merely by putting the control lever at the full speed setting. Braking can be controlled with the same lever without use of mechanical brakes. — Lewis-Shepard Products, Watertown, Mass.



Feeder Vibrations Produced by Impact

A recent English development is the Velfeeder, a vibrating feeder with an extremely wide range of perform-

ance and low power consumption. Vibration of the feeder is produced by a novel system of impact.

Feed tray of the unit has a working stroke varying from virtually motionless to a maximum of nearly $\frac{1}{4}$ in. at 1,850 vibrations per min. Vibrations are produced by collisions between an oscillating anvil and a rubber pad mounted on the feed tray. The anvil is caused to oscillate between springs by an eccentric weight assembly mounted on it which is driven by a $\frac{1}{4}$ -hp. motor.

Springs and mounting of anvil and feed tray are designed so that the two elements oscillate in opposite ways and collide once in every cycle.

The force of collision determines movement of the feed tray. Variation in the force of collision is obtained by altering the mean distance between the two masses. It is said little or no vibration is transmitted to frame.

Machine is offered with a variety of sizes and types of trays with either local or remote control. Positive automatic adjustment of feed rate can be supplied by an electronic servo controller.

Among the advantages claimed for this unit are its ability to handle an enormously wide range of materials. Particular emphasis is given to materials having characteristics such as high moisture content which place them outside the scope of conventional feeders.—Henry Simon Ltd., Cheadle Heath, Stockport, England.



Molded Paper Containers Without Joints or Seams

These containers of special pulp are molded to shape without joints or seams in nine sizes from 1 pt. to 5 gal. They are provided with friction-fit covers. Standard color is white.—Keiding Paper Products Co., 3048 N. 34th St., Milwaukee, Wis.

what materials would you choose

for these

CORROSION PROBLEMS?

1

Intricate casting for special valve must be completely corrosion resistant, even in holes. Weight is about 250 lbs., hence corrosion-resistant metals are too expensive. Chemicals handled are sulphites, bleaches, alums. After reviewing several materials, the valve manufacturer finally settled on . . . well, what would you use?



2

Dished head for evaporator, 5 ft. dia., handles solution containing hydrochloric acid, ammonium chloride, and zinc chloride. Temperature 212 deg. F, under 29 in. vacuum. What would you choose to give needed heat and chemical resistance?



3

Outdoor storage tank for hydrochloric acid holds 12,000 gallons. Built to last for years, it gives manufacturer big savings through bulk purchase of acids. What material would you specify?



1

Valve was cast of gray iron, then covered with an Ace hard rubber compound specifically developed for this application. The most intricate designs can be protected with Ace hard or soft, natural or synthetic rubber.

2

Because of the high temperature, this evaporator head was lined with an Ace synthetic hard rubber compound. Note the wide, straight seams, and the extra protection in corners and around flanges.

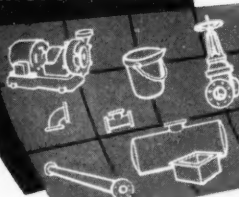
3

This storage tank must stand hot sun and freezing cold alike, so it was lined with Ace soft rubber. Inside this same plant, 1000 ft. of hard rubber lined steel pipe and two tanks lined with hard rubber are also at work.

▲

WITH HUNDREDS of rubber and plastic compounds to choose from, we can usually supply the *one best* answer to any corrosion problem, with equipment ranging from pumps, tanks, piping, valves and utensils to special molded or fabricated parts.

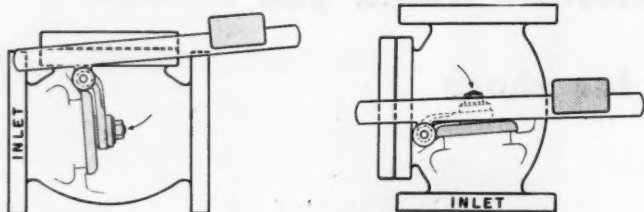
more RESISTANT
TO more CHEMICALS



ACE® rubber and plastic products

AMERICAN HARD RUBBER COMPANY
93 WORTH STREET • NEW YORK 13, N. Y.

NEW FLUIDS HANDLING EQUIPMENT



THESE check valves are loaded to stop reverse flow instantaneously.

How To Select Check Valves

Here are basic functions of weight and lever controlled swing check valves. Use them as a guide in ordering valves for your liquid handling lines.

A check valve equipped with outside lever and weight can perform two basic functions. The function that will be performed is determined by loading on weight arm and relative position of arm with respect to valve and direction of fluid flow.

The first check valve service considered is that of a valve extremely sensitive to flow reversal. For this purpose lever and weight are mounted so they will assist the disk in closing instantaneously. The moment flow stops, and before it has a chance to gain momentum in the reverse direction, the weight forces disk to close more quickly than it would by gravity alone.

An example of a perfect application for such a valve is on a centrifugal pump outlet operating against a high head. If pump is shut off, head pressure slows it down rapidly to the point where flow reverses. Delay in stopping flow reversal may permit build-up of reverse flow momentum. If this happens a sudden checking of flow will cause water hammer which may produce damage to valves or line.

Use of a check valve sensitive to flow reversal will prevent reverse flow from starting.

The second basic use for a swing check valve is where the check valve must open with a minimum of fluid pressure. To accomplish this result lever and weight are mounted so that they will almost balance the weight of the disk. Thus very little fluid pressure is needed to open valve and keep it open.

As seen in the sketches, lever and weight positions are different according to the function to be performed. Final position selected will also be influenced by direction of the pipe line and the fluid flow.

Once you have furnished the necessary information to the valve manufacturer, assembly of the right valve for your job can be carried out satisfactorily. Lever and weight are first carefully adjusted to accomplish the specified purpose. Disk and lever are keyed to hinge pin to continuously ensure proper relative location. On jobs requiring a balanced disk, weight position on lever arm is marked so that the balance point will always be known.

Points to remember—these check valves should never be installed in a position that will defeat their fundamental purpose; they should never be used as back pressure or unloading valves.—Crane Co., 836 S. Michigan Ave., Chicago, Ill.

Plastic Pipe Fittings Aid Turns, Take-Offs

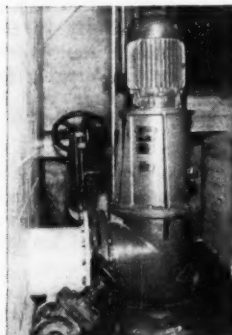
New insert type tee and ell couplings facilitate making sharp turns or take-offs from flexible plastic pipelines. One of these fittings now makes a connection which formerly required the use of three or four fittings.

All fittings are molded from a single piece of thermoplastic material and are guaranteed against rot, rust and electrolytic corrosion.

Fittings are joined to the plastic

pipe in the same manner as previously used for insert couplings. After fitting is inserted, stainless steel clamps are tightened over pipe and fitting to draw pipe down onto serrations of insert.

When flexible plastic pipe is to be joined to metal fixtures or pipes, an insert adapter is used. One end is screwed onto the metal threads. Plastic pipe is slipped over serrated end and clamped securely.—Carlson Products Corp., 10225 Meech Ave., Cleveland 5, Ohio.



Vertical Stock Pump Saves Floor Space

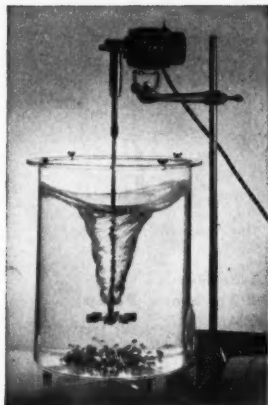
A recently developed vertical paper stock pump requires only one-third the space used by conventional horizontal type pumps. Another advantage with this design is that the possibility of air binding in the pump has been eliminated by permitting a positive head on the suction.

A number of design features have been incorporated to take advantage of the vertical construction. For instance, when the pump is in operation there is an upward thrust which tends to force the impeller upward against the shoulder of the impeller shaft. This removes weight from the lower bearing.

The bearing, constructed of Synthane plastic, is water-lubricated by a separate sealing water line. A solenoid valve in this line is interconnected with the motor circuit to guard against flooding during down periods. During operation an indicator tells the operator at all times whether or not sealing water is circulating through the Synthane bearing.

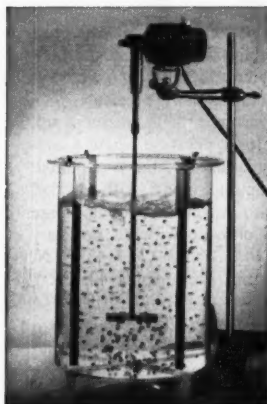
Other design features provide ease

How to get better results with



CHECK THE MIXER.

Does it draw a vortex like this? If so, solid particles may be heavily concentrated in tank bottom. This can mean time loss and power waste. It can cause overloading or damage to filters, pumps, other connected units in the system.



VORTEX IS ELIMINATED by properly baffling the tank, and by choosing an impeller that will efficiently lift particles of given size, density and settling rate. Result: you get the kind of suspension you want, with less horsepower, in minimum time.

Lightnin Mixers

for every fluid mixing job

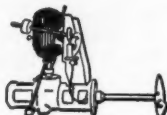
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fluid mixing specialists

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PORTABLE
3/8 to 3 HP



SIDE ENTERING
1 to 25 HP



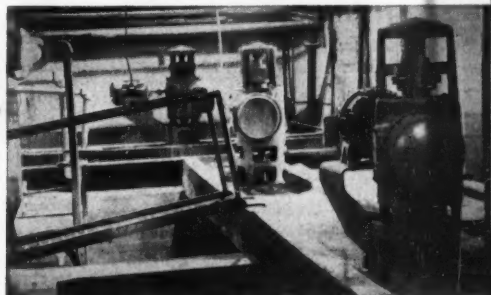
TOP ENTERING
1/4 to 500 HP

Solids Suspensions

Mixco can help you get better results on any fluid mixing job—often in much less time and with less installed horsepower than you are now using, or plan to use.

In fluid mixing, remember these two facts:

- Mixco engineers give you accurate prediction of results.
- LIGHTNIN MIXERS are guaranteed to do the job right.



THREE 10-HP LIGHTNIN MIXERS mixing a slurry in large compartmented storage tanks.

MIXING EQUIPMENT Co., Inc.

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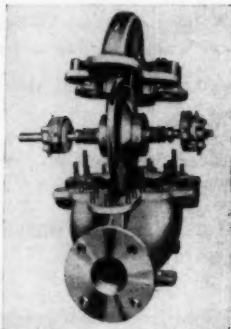
Company

Address

City Zone State

of maintenance and operation. Ample room around the stuffing box gland permits easy installation of packing rings. The suction elbow on the pump is furnished with two clean-out holes 5 in. in diameter located 90 deg. apart. This arrangement permits mounting a Hi-Density feeder vane assembly to improve operation when handling high consistency paper stock.

Heavy castiron construction in the pump casing and enclosed impeller makes for long life. This stock pump is now being built in five sizes, from 4 in. to 10 in. discharge, all with 16 in. suction port.—Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1, Wis.



**New Horizontal Pump
Is More Compact**

A new line of Peerless pumps standardizes on mechanical shaft seals rather than stuffing boxes. By this change the shaft length has been shortened to half that of conventional pumps of the same nominal size. Savings in floor space, improved performance characteristics and easier pump servicing are claimed.

The Type AS pump has a horizontal split-case design, allowing easy removal of the top half of the pump case for inspection and maintenance. Removal of the rotating element for inspection, repair or replacement is readily done without disturbing pump alignment or connections to the pump.

These pumps are available in discharge sizes from 1½ in. to 4 in. with capacities up to 750 gpm. at 230 psi. General application is for pumping water and clear liquids without suspended solids at temperatures up to 200 deg.—Peerless Pump Div., 301 West Ave. 26, Los Angeles 31, Calif.

Self-Closing Push Valve Controls Air, Gas Flow

Manual control of intermittent gas and air flow is provided by the King self-closing push valve. Typical applications include use with hydrostatic gages and other instruments requiring a manually controlled blast of air; use with single and multiple pressure test stands; use for blowing out or purging of gas or air lines; and use with processing operations requiring an occasional shot of gas or air.

Valve is opened by pressing a knob on the valve stem. Automatic closure occurs when the knob is released. Neoprene O-rings seal valve. O-rings are readily accessible by removing a nut and lifting out the valve stem. On breakdown tests the valve shows no leakage after one million cycles of operation.

Two different styles are available for either panel or in-the-line mounting. Inlets and outlets are tapped for ½-in. pipe. Discharge rate is 25 to 30 cfm. at a pressure drop of 100 psi.

—King Engineering Corp., Ann Arbor, Mich.

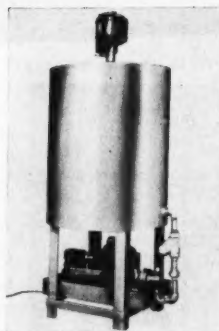


**Drip-Proof Coupling
Connects Transfer Lines**

A new coupling features a self-closing valve in each half of the coupling to eliminate drip when the coupling is opened. The valves fit flush with the coupling ends and are interlocked so that the coupling cannot be disconnected until the valves are closed.

Dangerous and corrosive liquids, such as nitric acid and titanium tetrachloride, can be safely transferred through the coupling without any loss when the coupling is disconnected, it is reported.

Stainless steel construction is used. The coupling is available in sizes to fit ¾ and 1½-in. pipe sizes. Fluid temperatures from -65 to 400 deg. F. can be handled satisfactorily.—E. B. Wiggins Oil Tool Co., Inc., 3424 E. Olympic Blvd., Los Angeles 23, Cal.



**Chemical Feeder
Combines Tank and Pump**

The new Baco chemical feed unit is a self-contained assembly comprising a welded steel tank and a proportioning pump. The tank, either 50 or 100 gal. in capacity, is provided with a specially designed motor-driven agitator. A stainless steel strainer is installed between the tank and the pump suction.

The pump is a high-pressure, low-capacity reciprocating plunger pump, designed for application where a controlled capacity of fluid is required. A duplex-pump model with divided tank is also available. Both units are supplied complete with all necessary piping.—Bird-Archer Co., 4337 N. American St., Philadelphia 40, Pa.

Process Pump Features Versatility

Special emphasis on handling corrosive and abrasive liquids with solids in suspension up to 5 percent guided the design of the new Type DS process pump. Either enclosed or open impeller design in discharge sizes up to 6 in. provide capacities up to 1,000 gpm. against a maximum head of 230 ft.

For temperatures to 250 deg. F. grease-lubricated bearings are provided, while above this range up to 600 deg. F., the bearings are oil lubricated, with provision for cooling the oil. It is also possible to water cool the packing. Where desired a mechanical shaft seal is available.

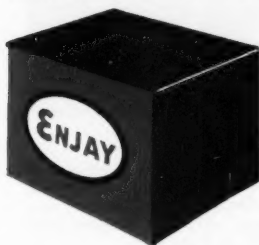
The pump frame construction is such that several different sizes of liquid ends can be used on each size of pump bracket.—Peerless Pump Div., 301 W. Ave. 26, Los Angeles 31, Cal.



The solvents and chemicals sold under the ENJAY* Oval Trade-Mark are outstanding for high quality and dependability. Every day more industries are calling on the long experience of the Enjay Company . . . making greater use of the diversified line of solvents and chemicals marketed by Enjay to increase product quality.

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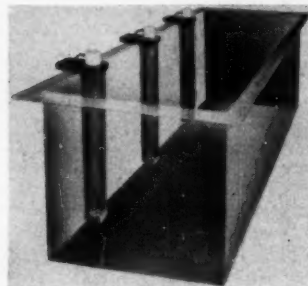
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Ethyl Ether
Isopropyl Ether
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ENJAY products are marketed in bulk or in quantities to fit your requirements.

NEW HEATING & COOLING EQUIPMENT



Immersion Heater Is Corrosion Resistant

The new Glorod electric immersion heater is said to overcome many problems inherent to heating corrosive solutions. Constructed of fused quartz, heater is totally inert to acids and requires no cleaning or maintenance. These features make unit ideal for heating all electro-polishing, electroplating, and phosphatizing solutions.

Since quartz is one of the best electric insulating materials known, there is no possibility of stray currents interfering with electroplating work.

Units are ruggedly constructed, but light weight for easy handling. A complete range of standard sizes is available from stock—Cleveland Process Co., 7016 Euclid Ave., Cleveland, Ohio.

New Adsorption Units Purify Air

A new line of air recovery and purification equipment is said to embody many improvements and new concepts in the utilization of activated carbon.

Advances offered by the new equipment include more rugged unit construction with longer life, plus greater exposure of carbon for greater efficiency than heretofore thought possible. Use is made of new activated carbons having increased adsorptive and retentive capacities, greater resistance to breakage and dusting, and more suitable particle form to give lower air resistance.

It is said that proper application of Nu-Air activated carbon equipment to air-conditioning systems reduces the amount of fresh air required. This in turn reduces the equipment load, producing operating savings and increased efficiency. On new installations this means a lower power requirement and greatly reduced instal-

lation costs. — Aerotrol Engineering Corp., 4135 Brownsville Rd., Pittsburgh 27, Pa.

Central Safety Control Protects Burners

Centralization of combustion safeguard equipment for 2 to 16 burners can now be accomplished with the new multiple burner Protect-O-Glo. System features individual flame detecting relays for each burner, with all relays housed in a single cabinet.

Suitable detector elements mounted on each burner are connected to the relays. In the case of oil-fired burners detector is a photocell, while on gas or gas-piloted oil-fired installations a flame electrode detector is used.

Flame detector and relay circuit act to shut down fuel supply in the event of flame failure at the burner.

Pushbuttons, signal lights and other components of safeguard circuit are housed in same cabinet with the relays.

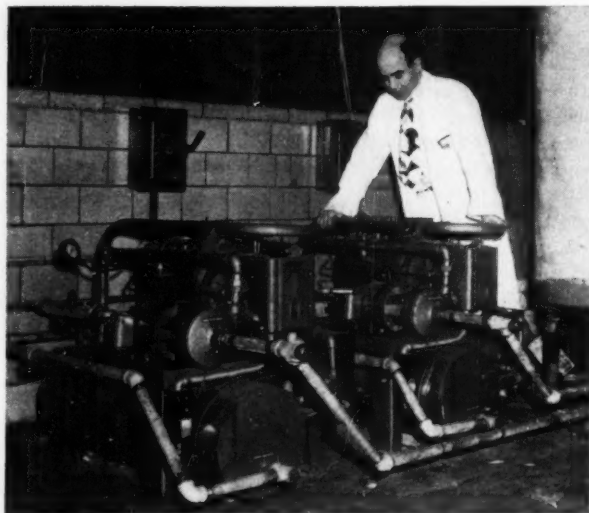
Three operating options are available. A sequence light-off, in which the second pilot valve doesn't open until the first pilot flame has been

proved; a unison light-off in which ignition of all burners takes place simultaneously; and an independent light-off in which each burner is individually ignited. — Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne & Roberts Aves., Philadelphia 44, Pa.

Low Temperature Unit Controls Humidity

A redesign of the Kathabar humidity conditioning unit provides for continuous delivery of low temperature air in the range from 32 deg. F. to minus 100 deg. F. Use of a circulating absorbent bath on the refrigerating coils eliminates the throttling of air passage by frost accumulation. At the same time air dew-point is lowered considerably below exit air temperature.

Air capacities for these units range from 1,350 cfm. to 5,000 cfm. Water removal varies from 30 to 290 lb. per hr. All elements of the unit are mounted on one base with the largest size measuring approximately 48 by 108 by 66 in.—Kathabar Div., Surface Combustion Corp., Toledo 1, Ohio.



LIQUID COOLERS USED IN CORTISONE PRODUCTION

These packaged liquid coolers furnish cold alcohol and ethylene glycol used by Parke, Davis and Co. in manufacturing cortisone and vitamin B-12. Animal glands are extracted with alcohol at 35 deg. F. The alcohol and extracted drug are then separated by freeze-drying technique using -10-deg. F. ethylene glycol refrigerant. Acme Industries, 618 N. Mechanic St., Jackson, Mich.

DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS

A refinery asked:

"How Fast Can You Clean Storage Tanks?"

307

308

Dowell Service cleaned **FIVE** . . . in just 40 hours

Storage tank cleaning has been speeded up by Dowell Service! That's what many operators say about the new Dowell method, using thickened chemical solvents.

A rust film had collected on the inside walls of five 6000 barrel storage tanks in a refinery. This film had to be removed to permit storage of a different product. Dowell engineers, using thickened solvents jetted through lances, cleaned the walls of all five tanks in just 40 hours. These thickened solvents . . . developed by Dowell . . . are designed to cling to vertical walls—dissolve unwanted deposits.

This type of Dowell Service has many

advantages for cleaning both the inside and outside of tanks . . . and other large surfaces. Scaffolding and dismantling are eliminated. Jobs result in a worthwhile saving of time and money. Dowell furnishes all necessary trained personnel, chemical solvents, pump trucks and controls.

Tank cleaning is just one of hundreds of applications for Dowell Service using chemicals for maintenance cleaning. For complete information and estimates on the cleaning of boilers, water lines, piping systems and processing equipment, call the nearest of more than 90 Dowell offices.

Other recent Dowell jobs

Gas washer and mains in a steel plant were cleaned by Dowell Service in 7 hours. Pressure drop across washer was reduced from 60" to 6".

Dowell Service increased capacity of a fractionating bubble tower from 500 gallons per minute to its original capacity of 800 g.p.m.

Flow through 400 feet of 4 inch water line had dropped to 125 gallons per minute. Dowell Service increased the flow rate to 228 g.p.m.

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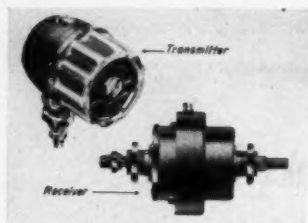
- ★ Maintenance cleaning service for industrial heat exchange equipment.
- ★ Chemical services for oil, gas and water wells.



DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

NEW INSTRUMENTS & CONTROLS



Manual Hydraulic Control Gives High Accuracy

A new hydraulic positioning control system is said to be ideally suited for remote manual control. A single tube links the calibrated transmitter with the receiver in the Hydrotorque system.

Remotely located valves, throttles, brakes, nozzles and other devices can be positioned merely by turning the transmitter knob. Complete freedom from sponginess gives the operator a feeling of direct linkage. Positioning accuracy and reproducibility are possible within a thousandth of an inch.

Hydrotorque will also indicate level, flow, static pressure and temperature.

Dial calibration can be furnished as desired in in. of water, lb. of pressure, lb. per min. or any other given designation. Automatic compensation is provided for expansion of the hydraulic fluid with increasing temperature.—Farris Hydrotorque Corp., 501 Commercial Ave., Palisades Park, N. J.

Pneumatic Controller Features Simplicity

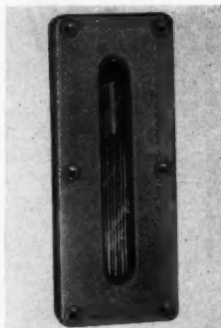
The Mason-Neilan 60,000 series pneumatic controllers are said to offer exclusive advantages in simplicity, range of adjustment and ease of accessibility for adjustment and servicing. These instruments are designed for precise control of pressure, temperature, liquid level, or rate of flow.

Among the types of control offered are proportional control, proportional reset control, on-off control, and differential gap control.

Design features include an exclusive, ingenious design for the proportioning mechanism. This incorporates the gimbal principle and provides for setting proportional band or reversal of control action with one adjustment. The reset unit includes resistance unit and capacity tank in one compact device. Patented tapered valve construc-

tion permits reproducible settings. Pilot unit is high capacity amplifying type with cleanable nozzle restriction accessible without removing chart plate.

Ranges that can be recorded and controlled are pressure up to 5,000 psi., temperature between minus 40 deg. F and plus 1,000 deg. F, flow between 0-20 and 0-200 in. of water, liquid level up to 50 ft. of water.—Mason-Neilan Regulator Co., 1190 Adams St., Boston 24, Mass.



Sight Gage With Wide Angle Visibility

Notwithstanding its contrary appearance, this reflex sight gage can be seen from angles up to 15 deg. off vertical or horizontal. It is made with cast iron housing, fluted sight glass and asbestos gaskets and is designed for temperatures to 500 deg. F. and vacuum or pressures to 15 psi. The gage can be furnished with transparent glass, if desired, and the housing made of cast stainless steel or vitreous enameled cast iron.

Standard visible length is 4½ in. On special orders you can get visible lengths up to 12½ in.—Rucker Co., 4516 Hollis St., Oakland, Calif.

Photoelectric Element Detects Flow Stoppage

A new application for photoelectric cells is in the detection of the presence or absence of liquid in a hose, tube or pipe. Coupled directly into a liquid line, as a valve would be, the light sensitive unit continuously monitors the liquid flow. Stoppage of flow is instantly signaled on the control panel.

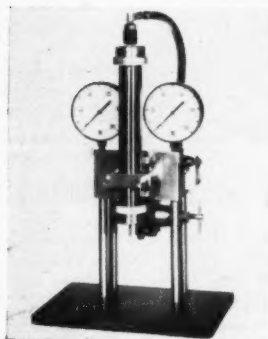
Sensing unit which serves as part of

line has three components. Exterior to the flow channel is a light source. In front of this and serving as part of line wall is a refracting cylindrical prism. On the opposite side of line are two sets of photovoltaic cells.

As light rays emanate from the light source and pass through the sensing system they are refracted different amounts, according to whether or not liquid is present. Light bent one way by the presence of liquid registers on the appropriate photoelectric cell. When no liquid is present light is bent by the prism so that the other cell is energized.

Each cell is connected to control panel so that fluid conditions in line are reported to that point.

Unit will operate under pressures of from 0 to 200 psi. With slight modification this system will report amount of vapor mixed with liquid in the line.—Wm. R. Whitaker Co., 915 N. Citrus Ave., Los Angeles 38, Calif.



Viscosity Cup Works at High Pressures

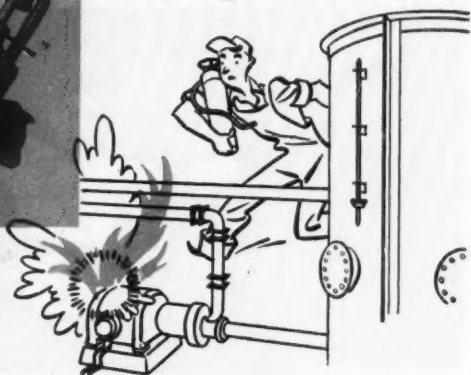
Viscosity measurements under pressures as high as 3,000 psi. are now possible with this new instrument, developed as a result of research on Vinylite dispersions by the laboratories of Union Carbide. Known as the Severs extrusion rheometer, the new instrument is said to be fast, accurate, simple to operate and easy to clean. It is especially suited for plastisols, organosols, mill pastes, inks, greases and dispersions.

Viscosities are measured in terms of pressure, quantity, time and orifice size. Various orifice sizes are available.—Castor Laboratory Equipment Co., 741 Shady Lane, Pittsburgh 34, Pa.

Minor Fire or Explosion?

YOUR
LINES

are SAFE with



Lapp TUFCLAD



Y-Valves and Angle Valves (in sizes to 6"), safety valves, flush valves, plug cocks, are available in Lapp solid porcelain with TUFCLAD armor. Also pipe and fittings (to 6") and a variety of special shapes.

Lapp

PROCESS EQUIPMENT

CHEMICAL PORCELAIN VALVES • PIPE • RASCHIG RINGS

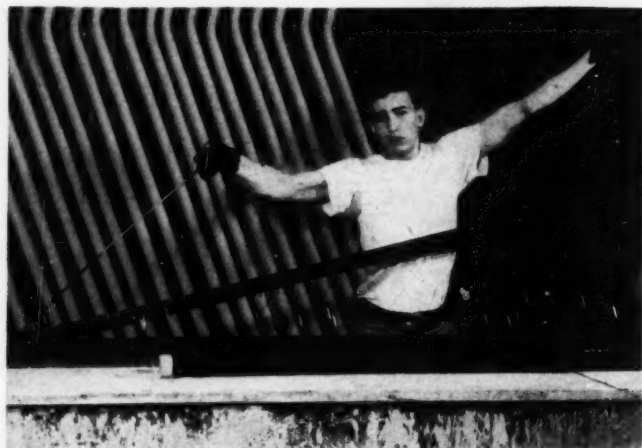
PULSAFEEDER CHEMICAL PROPORTIONING PUMPS

SOLID CHEMICAL PORCELAIN ARMORED WITH FIBERGLASS- REINFORCED PLASTIC

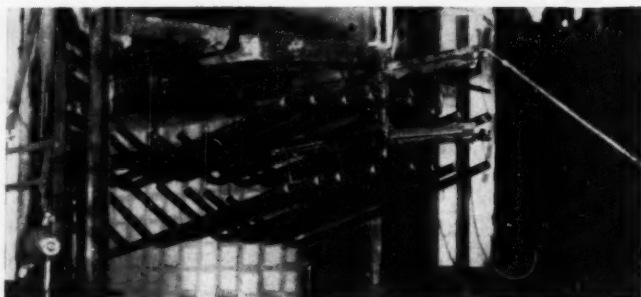
Now there's mechanical security to go with the chemical purity and corrosion-resistance of solid Lapp Chemical Porcelain. TUFCLAD armor is the answer—multiple layers of strong Fiberglass fabric impregnated and bonded to the body with an Epoxide resin of high strength and chemical resistance. It serves as an insulator against thermal shock—a cushion to accidental impact. And it is itself *tough* and strong, able to hold operating pressures against gross leakage even if porcelain is cracked or broken. Provide this protection to your personnel, equipment and product.

WRITE for description and specifications.
Lapp Insulator Co., Inc., Process Equipment
Division, 508 Maple St., Le Roy, N. Y.

NEW MATERIALS OF CONSTRUCTION



PIPES are dipped in enamel slip then hung for drying.



HERE pipes are leaving furnace following baking operation.

Porcelain Enamel Protects Pipe

Now steel chlorination tubes for fluxing aluminum alloys are protected by porcelain enamel. Tube cost is reduced two-thirds. Steel consumption is cut 93 percent.

Three years ago a steel chlorination tube used for fluxing and degassing aluminum alloys had a service life of 8 to 10 minutes. Today tubes in the same service last 150 minutes. Big jump in pipe life was launched by use of porcelain enamel coating on tube walls.

High specification aluminum alloy must be fluxed with chlorine gas. Black steel is the only pipe material considered satisfactory for this high temperature operation. And yet, the fast destruction rate of unprotected steel pipe adds a disproportionate cost

to the over-all operation. Also alloy contamination results from the combining of steel and chlorine at high temperature.

Personnel of Reynolds Metals viewed this problem as a budget harried father might regard a spendthrift son. They felt nuisance and expense could be greatly reduced—and by an ordinary procedure.

Basically, the high pipe mortality was attributed to: (1) the destructive power of high temperature molten alloy on steel pipe, and (2) deterioration by high-temperature chlor-

ine-supported combustion. Or stated another way—heat and corrosion were the culprits.

Reynolds men felt a possible answer lay in use of protective ceramic coating on steel pipe. Barrows Porcelain Enamel Co. was given the job of making the idea work.

First difficulty surmounted was in the application of liquid enamel to pipe surfaces. The nature of this problem is shown by pipe dimensions of 14 in. I.D. and as much as 14 ft. of length with a 45 deg. bend approximately 24 in. from exhaust end.

A satisfactory coating was finally applied by capping one end of pipe. Placed in an erect position pipe was then filled with enamel slip and allowed to drain slowly. Coating was then set by firing at temperatures of 1,300 to 1,900 deg. F.

Several finish coats can be applied over the initial coat in the same manner.

Temperature conditions in the molten alloy bath range from 1,250 to 1,350 deg. F. Bath surface temperature frequently reaches 2,000 deg. F. Original enamel coatings used would not withstand this heat.

Ordinary high temperature resistant enamels were unsatisfactory on two counts. They could not resist the corrosive conditions and their firing temperatures were too high for existing enamel baking furnaces.

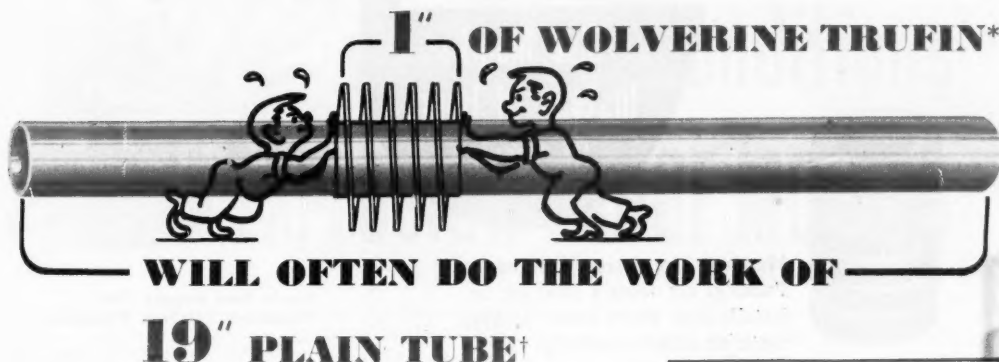
This problem was overcome by altering a corrosion resistant formulation to increase heat resistance by the addition of refractory material.

Success attained by the use of porcelain enamel in the fluxing and degassing process is attributed to the need for a coating having combined heat and corrosion resistance. If corrosion had not been a problem it is debatable that ceramic coating would have been used solely for its heat resisting qualities.

Barrows feels that other more expensive coatings could be used to secure still further savings of black steel pipe. However, the additional manufacturing costs are probably not warranted in the light of a certain amount of breakage resulting from rough plant handling.—The Barrows Porcelain Enamel Co., 137 Pleasant Ridge Station, Cincinnati, Ohio.

(Construction Materials, continued)

HOW TO CONDENSE A CONDENSER



By using Wolverine Trufin—the integral finned tube—in your condensers or heat exchangers, you obviously save space—get higher efficiency in performance—reduce equipment costs.

Being extruded from the tube itself, the fins are a solid part of the metal so you can absolutely trust them withstanding vibrations and extreme temperature changes. The hazard of separating the fins from the tube as a result of vibration or expansion and contraction is eliminated. More uniform temperature control is assured.

Specify Wolverine Trufin for your next retubing job or your installation of new heat exchangers or condensers. Send for our Bulletin that tells about operating heat exchangers efficiently.

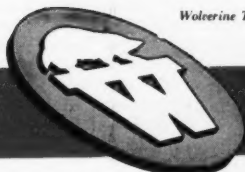
REG. U. S. PATENT OFFICE

WOLVERINE TUBE DIVISION

Calumet and Hecla Consolidated Copper Co.
INCORPORATED

Manufacturers of tubing exclusively
1427 Central Avenue • Detroit 9, Michigan

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.



PLANTS IN DETROIT, MICHIGAN AND DECATUR, ALABAMA
Sales Offices in Principal Cities

Export Department, 13 E. 40th St., New York 16, N. Y.

Sizes

5, 7 and 9 fins per inch

Copper

$\frac{3}{8}$ to $\frac{1}{2}$ " I.D. nominal

$\frac{3}{8}$ to $\frac{1}{2}$ " also in 19 fins per inch

5, 7 and 9 fins per inch

3S Aluminum

$\frac{3}{8}$ to 1" I.D. nominal

19 fins per inch

Copper $\frac{3}{8}$ " to $\frac{1}{2}$ "

3S Aluminum, $\frac{3}{8}$ " only

$\frac{3}{8}$ " 70-30 cupra-nickel, 90-10

cupra-nickel, 85-15 red brass,

1010 welded and seamless steel

$\frac{3}{8}$ " admiralty

Bi-metal (integral aluminum fins and copper liner)

$\frac{3}{8}$ to 1" 5 fins per inch

$\frac{1}{4}$ to 1" 7 fins per inch

$\frac{3}{8}$ to 1" 9 fins per inch

$\frac{3}{8}$ to 1" 11 fins per inch

†The equivalent outside surface area of a 19" length of plain tube $\frac{3}{8}$ " diameter, as an example, can be obtained in just one inch of Trufin of the same diameter. Other sizes show relatively the same savings in space.

CHEMISEAL PACKINGS

Give Months
Instead Of Hours
Of Service



NO. 711
CHEMISEAL
PACKING



NO. 620EG
CHEMISEAL
PACKING

Hundreds of reports say Chemiseal Packings are doing a good job on installations where other packing materials failed completely.

Good reason—they are made of Teflon* which resists all chemical attack excepting only molten sodium and fluorine. Chemiseal packing cannot contaminate the process. They require light gland pressure, permitting free shaft and spindle action, and are good from -110°F. to 500°F.

For rotating or reciprocating shafts, select Chemiseal Type 711—the packing that imposes least torque on the shaft and not only prevents axial seepage, but seals against stuffing box and shaft as well.

For emergency service, select Chemiseal Extruded Packing No. 620EG (graphite impregnated) or No. 620EM (with mica), applicable to valves, pumps, or any stuffing box application. Write for catalog or tell us your specific packing problems.

See our Exhibit, Booth 31, Seventh National Chemical Exposition, Chicago Coliseum, SEPT. 9th and 13th Inc.

*DuPont's trademark
for its tetrafluoroethylene resin.

**UNITED
STATES
GASKET
COMPANY**

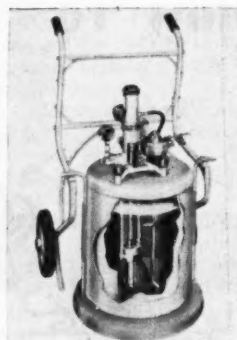
**FLUOROCARBON
PRODUCTS DIVISION**

FABRICATORS OF "TEFLON", KALF[®]
AND OTHER FLUOROCARBON PLASTICS

CAMDEN 1, NEW JERSEY



EQUIPMENT NEWS, cont. . .



Spray Gun Supply Unit Combines Mixing, Pumping

Maintenance and production painting men are offered a new spray-gun supply unit. Known as the portable heavy-duty Paintmaster, this unit works directly from either 5 or 10-gal. original containers.

An air-operated double-action reciprocating pump delivers the paint to the spray gun. A separate adjustable air-operated, dual-bladed agitator keeps the materials well mixed— independent of paint pump operation. Both pump and agitator are mounted on top of a housing inside of which is placed the paint container. Lugs are fastened to the outside of the housing to allow for picking the unit up with a special hand truck and transporting it wherever desired.

The pump is powerful enough to use with long lines or multiple spray guns even in colder temperatures.—Gray Co., Inc., 1012 Sibley St., Minneapolis 13, Minn.

Gas Welding Flux For Aluminum, Stainless

No. 35 aluminum and stainless steel flux may be used as either a powder or paste for gas welding. It was developed especially for use with the new X-2S and X-43S aluminum rods.

According to the manufacturer, the new flux spreads evenly and thinly ahead of the flame, cleans oxides efficiently ahead of puddle, floats any remaining impurities smoothly out of the puddle, and protects the aluminum or stainless on each side of weld area. It does not break down even at temperatures required for welding stainless and does not flake off and leave surface unprotected, causing rough bubbly weld.—All-State Welding Alloys Co., Inc., White Plains, N. Y.



"Safe" under any conditions



EXPLOSION-PROOF MOTORS

Louis Allis explosion-proof motors have the Underwriters' Laboratories approved labels for all types of hazardous conditions—Class I, Group D for explosive liquids and vapors; Class II, Group G for combustible dust; Class II, Group F for carbon black, coal and coke dust; Class II, Group E for combustible metal dust.

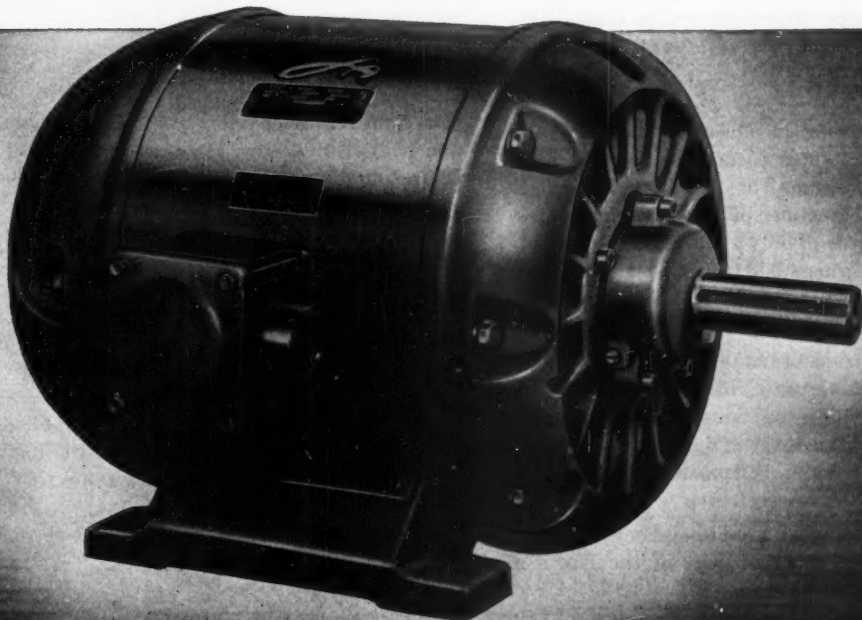
There is a modern streamlined Louis Allis Explo-

sion-Proof motor to satisfy your most exacting specifications. A careful comparison and analysis will show you that Louis Allis Explosion-Proof motors offer you more dependable performance, convenience, long life and safety.

For quick, dependable service contact your nearest Louis Allis Sales Engineers.

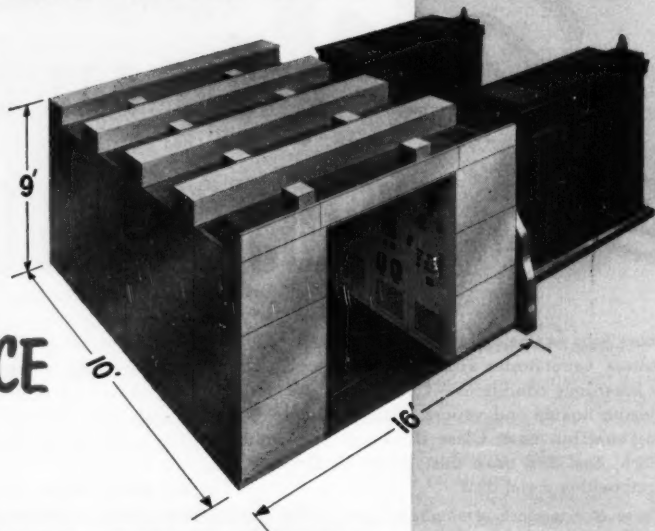


THE LOUIS ALLIS CO., Milwaukee 7, Wis.



RECTIFY AC TO DC WITH 96% EFFICIENCY

...IN SMALL,
COMPACT SPACE



Install I-T-E MECHANICAL RECTIFIERS

On processes requiring a heavy, steady supply of direct current, I-T-E Mechanical Rectifiers yield big dividends. Not only do they give you more d-c for the power you buy (96% efficiency from a-c line to d-c bus) but you also get more power per cubic foot — *high capacity in small space*.

SAVE SPACE

Simplicity of design plus unified arrangement of steel enclosures assures most economical use of floor space. The 10,000 ampere I-T-E Mechanical Rectifier pictured here requires a *total* floor area of only 160 square feet including operating aisle. A 5,000 ampere installation requires only 120 square feet including aisle. Ceiling need be no higher than 12 feet.

Power transformers are normally located outdoors and throat-connected to the Rectifier cubicle through an outside wall. Overall dimensions vary with KVA and ratio of the transformer. A 1000 KVA transformer nominally occupies 35 square feet.

The primary a-c circuit breaker which feeds the transformer forms part of the Rectifier

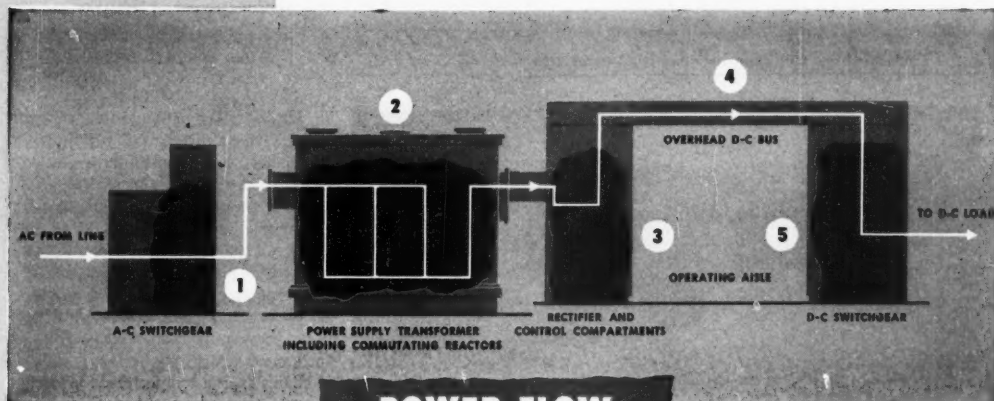
installation, but is ordinarily included in a line-up of HV switchgear at some convenient remote point. A 5 KV circuit breaker, 100,000 KVA interrupting capacity, 1200 amperes continuous rating (draw-out construction), occupies 10 square feet of floor space.

SAVE ON BUILDING COSTS

The compact Mechanical Rectifier installation is light in weight. It requires no special floors, foundations, or high ceilings—no basement or trenching for buses. The Rectifier stands just 9 feet tall—including *overhead* bus —on an ordinary level floor.

SAVE ON INSTALLATION COSTS

Factory assembled, wired, and tested, the I-T-E Mechanical Rectifier is delivered as a packaged unit—ready to install. No special equipment or crane facilities are needed. Just unload components, skid enclosures into position, wheel truck-mounted elements into cubicles, connect . . . and the Rectifier is ready to deliver long, dependable service.



POWER FLOW FROM A-C LINE TO D-C LOAD

A complete I-T-E Mechanical Rectifier includes: primary a-c circuit breaker, transformer, commutating reactor, contact mechanism, d-c switchgear, and associated instruments and controls.

Incoming alternating current is fed through primary circuit breaker (1) into the combined transformer and commutating reactor (2), to the contact mechanism (3), where it is converted to direct current.

The direct current then travels across the overhead bus (4), through d-c switchgear (5) to feed the load.

CAPACITY RANGE

Standard ratings for unit installations are: 3000, 4000, 5000, 6000, 7000, 8000, 9000, and 10,000 amperes. Any additional desired capacity may be obtained by paralleling units of suitable ratings.

Output voltage may be any voltage between 50 and 400 volts d-c.

Common primary voltages are: 2300 volts; 4160 volts; 13,800 volts; and 23,000 volts; three-phase, 60-cycle, a-c.

GET THE COMPLETE STORY

If you're planning new or expanded power conversion facilities, it will pay you to investigate the advantages of I-T-E Mechanical Rectifiers. You get maximum efficiency—in minimum space. You save all along the line.

For complete information, get in touch with your local I-T-E representative without delay. Or, send for illustrated *Bulletin 5106* today.



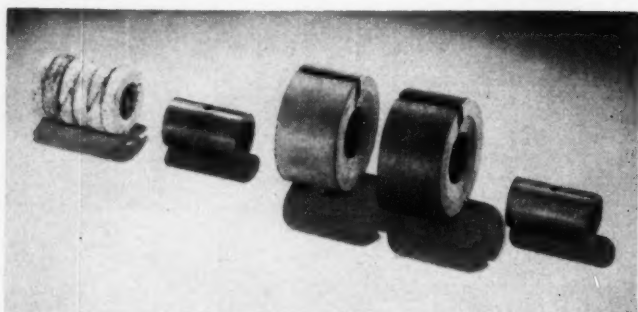
MECHANICAL RECTIFIERS

I-T-E CIRCUIT BREAKER COMPANY

Rectifier Division

19TH AND HAMILTON STREETS, PHILADELPHIA 30, PENNSYLVANIA

Canadian Mfg. and Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Phillips Export Corp., N.Y. 17, N.Y.



Chemical pump impellers and bearings can now be made of Teflon and fine metal powder; pump packing is of Teflon and a filler. All are immune to chemical attack.

Mixtures Help Harness Teflon

Putting the fluorocarbon polymer into mixtures with metals or fillers makes its superb chemical and electrical properties available for many more uses.

Drastically lower in cost than Teflon and easier to fabricate—the bonuses offered by new metal surfaced and other combinations of the fluorocarbon. Fillers used in these mixtures are relatively low-cost and serve to minimize inherent limitations of the fluorocarbon in mechanical and thermal properties. At the same time, many of Teflon's unique chemical and electrical properties remain.

Filled fluorocarbons are being used commercially for bearing surfaces and rigidity in a chemical pump. Bearings and impellers are all made from one type of filled fluorocarbon while packing is of still another type.

The pump has been used on acid and caustic applications. Previously the impellers required changing every few weeks. Now they last over six months. Other pumps using similar Teflon-composition parts have been found capable of running at much higher speeds and capacities than previously rated.

Eco Engineering Co., New York, who make a line of the pumps state that they will convey virtually all fluid chemicals in the widest viscosity ranges. They go on to say that purchasing agents need no longer concern themselves with specifications for any particular acid, emulsion, alkali,

solvent, oil, organic or inorganic. Their pump handles them all.

The Teflon content takes credit for these excellent qualities. The filler accounts for the pump's relatively low cost.

One of the most valuable new fields opened up by fluorocarbon combination materials is metal-surfaced Teflon, now commercially available. This is suitable for hermetic sealing, soldering, welding or other bonding purposes. The preform is constructed with a base of pure Teflon.

Over that are several layers of mixtures of fluorocarbon and fine metal powder. An increasing percentage of metal is in the layers near the surface. Thus the material gradually changes from a pure dielectric to a semiconductor as the number of metal particles in a given volume increases as they approach the surface. The surface itself is sufficiently electrically conducting and provides enough metal-bonding area to take pure metal coatings either by conventional plating or spray techniques.

Exploitation of Teflon's chemical inertness as well as its dielectric properties has been hampered in many cases by its large thermal expansion, unsatisfactory dimensional stability and inability to adhere to anything.

The new Teflon shapes made from the polymer mixed with other materials take a big step toward solution of these problems. The technique of manufacturing them consists of thoroughly mixing fine particles of the filler material with Teflon powder before making a preform. This is made by compressing the powdered mixture at about 2,000 psi. without heating. The preform is then baked without pressure at a temperature above Teflon's critical temperature (327 deg. C.) a procedure which produces sintering.

The fluorocarbon envelopes the individual fine particles of the filler bonding them together in a homogeneous mass. These particles are protected by the surrounding fluorocarbon's inherent resistance to humidity, fungus and inertness to chemicals. Molded metal-bearing mixtures, for example, do not require any further finish to protect them from rust and corrosion.

Sheets, rods, tubes and shapes of medium complexity can be produced. They have the characteristic machineability of Teflon itself. The added material modifies the properties of the mixture in accordance with its own. Some fillers used for the metal-surfaced Teflon are calcium fluoride, ceramics, mica, glass, quartz, calcium silicate.

Cost reduction is one of the biggest jobs these fillers do. Calcium silicate, for example, costs only pennies per pound compared to dollars per pound for Teflon. Yet its chemical and electrical properties are good enough to avoid trading off too many of Teflon's basic advantages. So both cost and quality allow the mixture to be used over a much wider range of applications than Teflon itself.—United States Gasket Co., P. O. Box 648, Camden 1, N. J.

Anti-Staining Sealer

For use over asphalt, coal tar and gilsonite coatings, including mastics.

Synthetic resins and a combination of leafing-type metallic pigments go into a new sealer called Prufcoat Sealer P-25M. It is aimed at making

active-solvent corrosion resistant coatings easier to use under practical plant conditions.

It is said to form a barrier film over all surfaces which might otherwise be lifted or wrinkled by the active solvents in finish coatings. Thus after P-25M is applied over asphalt or similar coatings, a vinyl or synthetic resin top coating may be applied without danger of bleeding or staining.

The new sealer may be put on by either brush or spray. Coverage varies from 250 to 400 sq. ft. per gal. depending on roughness or porosity of the surface being sealed.

Normally one hour air drying is sufficient. The coating dries by simple evaporation of volatile solvents which are a type having minimum effect on conventional oil paints, asphalt coatings, etc.—Prufo Coat Laboratories, Inc., 63 Main St., Cambridge 42, Mass.

Aluminum Paint

Protects furnaces, pipes, boilers and other metal surfaces which must withstand heats to 1600 deg. F.

The greater the heat, the more permanent the protective bond—that's what the manufacturers say of their new ready-mixed aluminum paint, Super-Hot. When temperatures of from 500 to 1,600 deg. F. are applied, the paint alloys itself to practically any metal surface.

The coating is guaranteed to remain bright and totally fused to the surface up to a minimum of 1,600 deg. F. It is anti-corrosive, impervious to most ordinary solvents and is heat and weather-resistant.

It may be brushed, sprayed or dipped and air dries within 30 min. Then heat can be applied.

Although best results are obtained when application is made on clean dry surfaces, Super-Hot may be applied to surfaces which are rusty, moderately greasy or oily.—Sheffield Bronze Paint Corp., 17814 Waterloo Rd., Cleveland 19, Ohio.

Alcohols and Glycols

A group of tertiary alcohols and glycols.

Now coming out of a new plant at Bound Brook, N. J., in drum quantities are 2-methyl-3-butyn-2-ol; 3-methyl-1-pentyn-3-ol; 2,5-dimethyl-3-

IN BRIEF—A capsulated listing of this month's newsworthy products

It's New . . .

Teflon Mixtures
Sealer
Aluminum Paint
Alcohols and Glycols
Fungicide Paint
Intermediates
Water Conditioner
Insecticide
Silicone
Fine Plastic Fiber
Defoliant
Polytetrafluoroethylene
Tape
Cement
Trioxane
Vinyl Chloride

It's Good For . . .

Make superb properties available at lower cost..... 196
Use over asphalt, coal tar and gilsonite..... 196
Protecting almost any metal surface from heat..... 197
Non-habit-forming sleeping drug..... 197
Non-toxic protection of walls in food plants..... 197
Dyestuffs, pharmaceuticals and rubber chemicals..... 197
Combats fouling in heat exchangers and condensers..... 198
Controlling apple and pear pests..... 198
A water repellent for masonry..... 198
Making tissue-thin paper which drapes like cloth..... 198
Cotton and in arid areas..... 200
Electrical insulating film..... 202
Bonding of foamed materials..... 204
Solid fuel for heating field rations..... 204
Film and sheeting..... 204

See Page . . .

hexyne-2,5-diol; and 3,6-dimethyl-4-octyne-3,6-diol.

A new non-habit-forming sleeping drug takes advantage of the hypnotic properties of methyl pentynol. Dimethyl hexynediol provides an alternate starting point for the involved allethrin synthesis replacing the usual methallyl chloride.

The reaction of acetylene and acetone to yield methyl butynol was studied in Germany on a pilot plant scale using Reppe techniques. However, space-time yield was reported very poor.

According to the Bound Brook manufacturers, Reppe chemistry is not involved in their process. They do, however, use a ketone and acetylene as raw materials. They claim good yields of either the alcohol or the glycol.—Air Reduction Chemical Co., 60 East 42nd St., New York 17, N. Y.

Fungicide Paint

Mildew resisting, nontoxic enamel for walls of packing houses and in other food processing industries.

A basically new fungicidal finish has been tested on panels in rooms where ordinary paint is covered with a profuse mold growth within 2 mo. After 18 mo. the panels are still mildew-free.

Cunilate, or copper-8-quinolinolate, made by Scientific Oil Co., Chicago, is the nontoxic fungicide ingredient of the new finish. It is rated by government agencies as the most effective safe fungicide yet evaluated for paint purposes.

The fungicide must be incorporated in the enamel in the course of manufacture. Adding it to the completed product impairs consistency. Also

some pigments react with Cunilate. And it has been proved that some formulations yield better results than others.

Use of the enamel is foreseen in food processing areas where mildew control is a serious problem: packing houses, breweries, bakeries and dairies. And possibility of its use in textile plants is also good.

Although technically being introduced on a trial basis, the manufacturer feels sufficient test experience is behind it to warrant starting production.

Because the finish contains a high percentage of Cunilate to the gallon, it has a greenish-yellow cast not regarded as sufficiently pronounced to be at all objectionable.—E. I. du Pont de Nemours & Co., Wilmington, Del.

Intermediates

Suggested for the manufacture of dyestuffs, pharmaceuticals and rubber chemicals.

Two new intermediates are now available; o-ethylnitrobenzene in commercial quantities; and o-ethylaniline which will be produced in pilot plant amounts.

A yellow to green clear liquid, o-ethylnitrobenzene boils at about 228 deg. C., crystallizes at -12 to -14 deg. C., is miscible in most organic solvents and immiscible in water.

O-ethylaniline may be obtained from the o-ethylnitrobenzene by selective reduction.

When subjected to liquid-phase air oxidation in the presence of chromium oxide, o-ethylnitrobenzene yields o-nitroacetophenone. The nitroacetophenone, in turn, can be selectively reduced to prepare o-aminoacetophenone. This latter intermediate prob-

ably offers the greatest number of opportunities for the formation of derivatives wherein both functional groups attached to the benzene ring are simultaneously useful.

The second newly available intermediate, *o*-ethylaniline, is a yellow liquid which darkens on standing. It boils at 215 deg. C., is miscible in alcohol and benzene and slightly miscible in water.

It is a compound which is essentially an aromatic amine and can be expected to react in a way typical of that class of compounds.

The common reaction of diazotization may be interfered with to a certain degree by the presence of the ethyl group in the *ortho* position but the reaction is nevertheless possible.

Other reactions to be expected of *o*-ethylaniline include those with phosgene and carbon bisulphide to form respectively: the corresponding isocyanate; the corresponding *N*-substituted thiourea. The corresponding guanidine may also be prepared.—Monsanto Chemical Co., St. Louis 4, Mo.

Water Conditioner

Combats fouling, plugging and corrosion in heat exchangers and condensers.

When added to treating water used in heat exchangers or condensers, new Pur-O-San Extra is adsorbed at metal surfaces in the form of a thin impervious film. It is said to prevent contact between corrosive elements and metals.

The film barrier retards thinning of tube walls, protects against algae and sludge. It does not change the clearance between baffles and shell.

To obtain best results, it is first recommended to circulate Pur-O-San through the system to remove scale, sludge and similar soft deposits. This will de-scale heat exchangers without dismantling and reassembling.—Pur-O-San Co., Bradford, Pa.

Insecticide

Of relatively low toxicity to man, it effectively controls apple and pear pests.

A new pesticide called Penthon is much less toxic to man than fellow organic-phosphate-type products. Its active insecticidal chemical, malathion,

is approved by the U. S. Dept. of Agriculture for control of mites and woolly aphids on apples, and mites and pear psylla on pears.

Penthon is also thought to be effective for other uses which are now being developed by experimentation. It has been tested extensively as a spray and in an aerosol on ornamental plants, out-of-doors and under glass. It shows exceptionally good plant tolerance to a wide variety of plants.

It is sold in both powder and liquid form: Penthon E-50, an emulsifiable concentrate containing 50 percent malathion; Penthon W-25, a wettable powder containing 25 percent malathion. Both may be used with the more commonly known insecticides.

Penthon E-50 is packaged in 5-gal. resin-lined steel drums and Penthon W-25 in 50-lb. fiber drums.—Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.

Water Repellent Silicone

For use as a masonry water repellent. Its water solubility imparts advantages over older silicones.

Sodium methyl siliconate offers a unique combination of properties: water-repellency plus water solubility. These properties give it an edge over other silicones in water-repellent masonry applications. Thus, it can be incorporated with concrete during mixing; it renders limestone and gypsum water repellent.

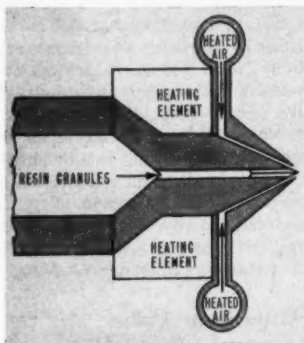
Called SC-50, it can be applied directly to surfaces or used as an integral mix to impart water repellency to a variety of materials. It can also be used as a chemical intermediate in the manufacture of water repellents or other chemical materials where the properties imparted by silicones are desired. It is nonflammable, noncorrosive and odorless.

Although the major use for the product at this time is for masonry water repellents, development work indicates that SC-50 may invade other markets: water repellents for textiles and paper products, catalyst preparations, water-repellent aerogels, additives for sodium silicates and for water-base paints to improve washability.

Now in pilot plant production at Waterford, N. Y., the new silicone is available in drum lots.

Supplied as a liquid with 20 per-

cent silicone solids content, (31 percent total solids), SC-50 is light amber in color and can be cured at ambient temperatures. By following suggested handling instructions, it can be dried to a white powder which can be redissolved in cold water.—Chemical Division, General Electric, Pittsfield, Mass.



Fine Plastic Fiber

Submicron fibers from new extruder nozzles, see above, feed directly to a moving screen forming tissue-thin, strong fabric.

A method has been developed for making fine plastic fibers into sheets from commercially available silicone fibers. The new material combines the appearance of tissue-thin paper with draping qualities of cloth. Neither paper-making or textile-carding techniques are used in its manufacture.

Application as a longer-lived insulation for electrical apparatus is expected. Its dielectric strength is higher than glass. It will withstand an operating temperature of 250 deg. F., which exceeds temperature requirements for Class H insulation.

Its water repellency suggests applications for protective clothing.

The product should be relatively low cost since the process requires neither critical paper-making or textile machinery. The basic resins are heated, combined with air, and then sprayed onto a fine metal screen from which the resultant nonwoven fabric can be removed. The screen serves to separate the fibers from the air stream. Preliminary guesses place operating costs at a few cents per pound of fiber produced, with hot compressed gas the principal item of



"Wonder-worker" for the wonder drugs

**How
Celite
filtration
assures purity,
speeds production**

When producers of antibiotics sought a filter aid that would assure removal of all mycelium and other gelatinous impurities in the broth from which wonder drugs are extracted—and speed their "put-through" in the bargain—Celite ended the search.

The effectiveness of Celite can be attributed to these important factors which make it unique among filter aids:

Carefully processed from the purest deposit of diatomaceous silica known, Celite is available in nine standard grades—each designed to trap out suspended impurities of a given size and type. Whenever you reorder, you are assured of the same uniform, accurately graded powder re-

ceived in your initial order. Thus, with Celite, you can count on consistent purity in your filtrates—at highest rate of flow—month after month, year after year.

The manufacture of wonder drugs is just one of the many processes in which consistent purity and faster filtration have been obtained through the use of Celite. Your own filtration problem, regardless of the product involved, can no doubt be solved with the proper grade of Johns-Manville filter aid. To have a Celite Filtration Engineer study your problem and offer recommendations, without cost or obligation, just write Johns-Manville, Box 290, New York 16, N. Y.

Celite is a registered Johns-Manville trade mark



Johns-Manville CELITE

FILTER AIDS

1 man.... 
 1 minute.... 
 1 mobile unit.... 

.... and the fire's out!

That's right. It takes one man just one minute at the nozzle of this latest model *Kidde* Wheeled Extinguisher to discharge all of 150 pounds of fire-choking dry chemical. And, Mister, 150 pounds of dry chemical can snuff out a mighty big fire.

Kidde's "instant flow" nozzle and adjustable hand control means you can beat back fire with a 30-foot-range "straight stream" or blanket it with an improved "fan" pattern.

If you want really powerful protection against exceptionally large fires in live electrical equipment, flammable liquids, textiles, etc., you want a *Kidde* 150 pound Dry Chemical Wheeled Extinguisher. Write today for full information



Kidde

Walter Kidde & Company, Inc.,
 828 Main Street, Belleville 9, N. J.

Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.



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PRODUCT NEWS, cont. . .

expense. From one pound of resin will come 400,000 miles of fiber.

The apparatus is essentially an extruder. Hot resin melt goes through a row of fine orifices and into a high-velocity stream of heated gas, usually air. Fiber formation occurs just beyond the apex of the nozzle, where the upper and lower streams of hot gas converge, pick up the molten plastic and stretch it.

Proper adjustment of the gas stream angle (about 30 deg.) produces a minimum of discontinuities in the filament. Nozzle design assures immediate resumption of attenuation following breaks.

The extruder feeds dispersed fiber to a moving screen. Dry fabric of random mesh fibers are formed.

Submicron diameters of the fiber insure homogeneous sheets free from pinholes. Fabric also appears to be flexible and strong.

Actually, raw material for this method of fiber production is not limited to silicone plastic fibers. The equipment and process for producing submicron fibers have been tested successfully on other thermoplastics like nylon, Dacron, polyethylenes and Kel-F. In general, polymers which melt sharply to give viscosities well under 1,000 poises (like nylon) will attenuate to the finest diameters.—Naval Research Laboratories, Washington 25, D.C.

Defoliant

Excels for cotton and in arid areas.

What is believed to be the first complex organic chemical compound successfully used for defoliation is being marketed this season in limited quantities.

Chemically, it is disodium 3,6-endoxohexahydrophthalate. It is called Endothal Defoliant S-4069.

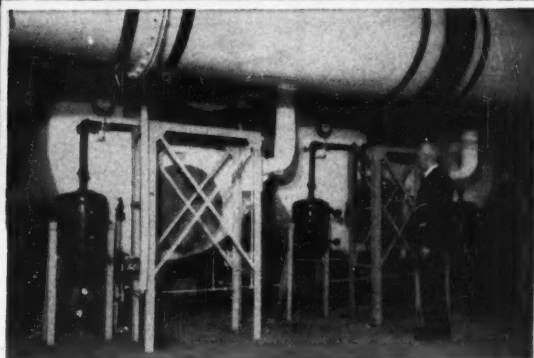
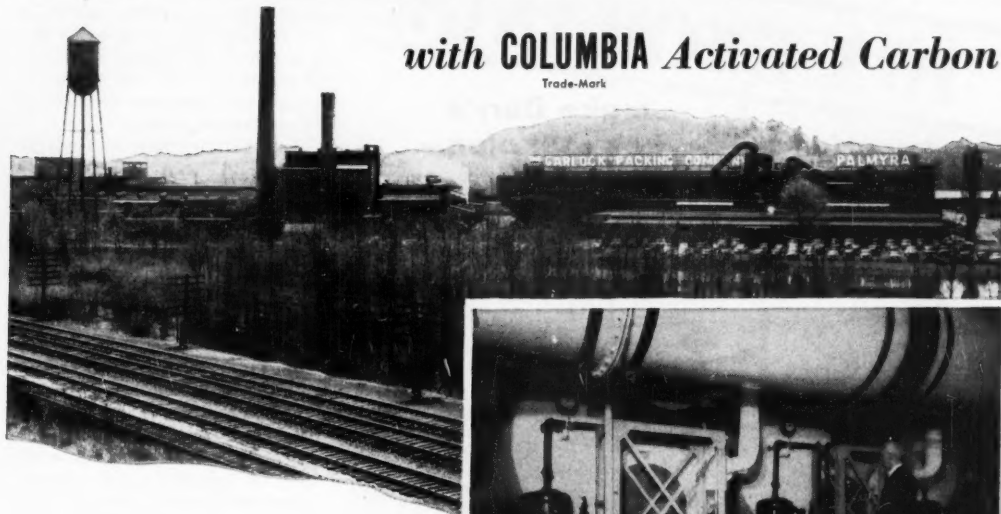
Tests in cotton-growing areas revealed that endothal's chemical action closely parallels natural defoliation. That is, instead of simply killing the leaf it causes an abscission to form at the butt of the leaf stem, thereby causing the leaf to drop while still green. This is a particular advantage in cotton defoliation because dry leaves break up, increasing leaf trash.

Tests also showed that endothal is more effective than some other defoliants in arid areas, where moisture

95% of Gasoline Solvent Recovered

with COLUMBIA Activated Carbon

Trade-Mark



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Send for our 16-page booklet "How 7 Industries Save \$150,000,000 a year with COLUMBIA Activated Carbon" which tells how other companies have profited. A request on your letterhead will bring you a copy, without obligation. Write today.

CARBIDE AND CARBON CHEMICALS COMPANY

A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street **UCC** New York 17, N. Y.



A modern solvent recovery plant for The Garlock Packing Company, Palmyra, New York, using COLUMBIA Activated Carbon as the adsorbent, collects about 1,000 pounds of gasoline vapor per hour from the air and delivers it ready for re-use. The gasoline is vaporized during the manufacture of asbestos sheet packing and is recovered at lower cost and higher efficiency than is possible with any other commercial method. Operating records for a 10-month period since the plant started show an *overall* recovery efficiency of 95.9 per cent. In addition to the profitable recovery of gasoline, this installation also:

- improves the working conditions in the plant,
- helps reduce the hazards of handling gasoline vapors,
- avoids the discharge of large volumes of solvent-laden air into the atmosphere.

The special features of CARBIDE's automatic equipment and the high adsorptive capacity of COLUMBIA Activated Carbon make such performance possible for Garlock Packing.

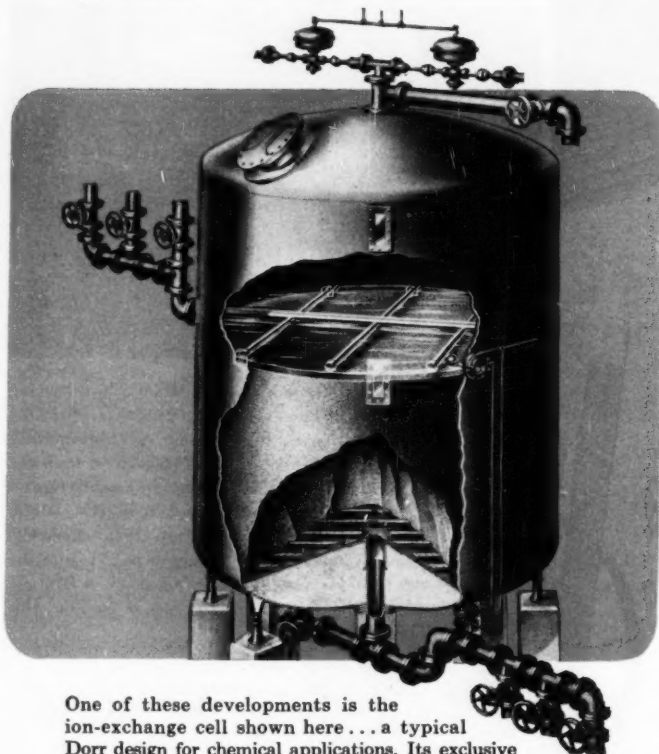
If you vaporize solvents in your process, let CARBIDE help you conserve valuable solvents, improve processing conditions, and clean up exhaust air. We can supply you with a complete, automatic, instrument-controlled plant designed for your specific requirements with guaranteed operating efficiency to recover solvent vapors or purify industrial gases.

"Columbia" is a registered trade-mark of Union Carbide and Carbon Corporation

When you're thinking of ION-EXCHANGE

make Dorr's
experience a part of your plan—

Equipment for the increasing use of ion-exchange techniques in the chemical process industries is being continually developed and improved by Dorr engineers. Whenever you are thinking of ion-exchange make use of our experience . . . from problem analysis to initial plant operation.



One of these developments is the ion-exchange cell shown here . . . a typical Dorr design for chemical applications. Its exclusive features provide . . .

- **Minimum dilution of solutions** treated, through use of air-dome operation with automatic level control.
- **Maximum use of cell volume** by elimination of inert supporting medium for exchange resins, through use of non-clogging under-drain distributors.



Better tools TODAY to meet tomorrow's demand

DORR

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

THE DORR COMPANY • ENGINEERS • STAMFORD, CONN.
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PRODUCT NEWS, cont. . .

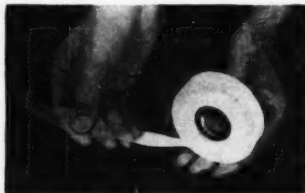
stress in the plants frequently makes defoliation more difficult. In tests for soil contamination it was found that it is virtually nonexistent in the case of endothal because the product is quickly and completely disintegrated by soil microorganisms.

Endothal is fairly economical. About one gallon is sufficient for one acre of cotton.

Sold in liquid form, in 5 and 54 gal. drums, it goes into water solution rapidly and completely.

Tests for other uses for endothal have been promising. Even when used in moderate amounts, it has worked well as a defoliant or preharvest desiccant on a relatively wide range of crops.

Applications as a herbicide look promising. Tests on pre-emergence and post-emergence treatment on the basis of individual plant tolerance have shown favorable results on weeds not normally controlled by other chemicals and difficult to control by cultivation.—Agricultural Chemicals Dept., Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.



Polytetrafluoroethylene Tape

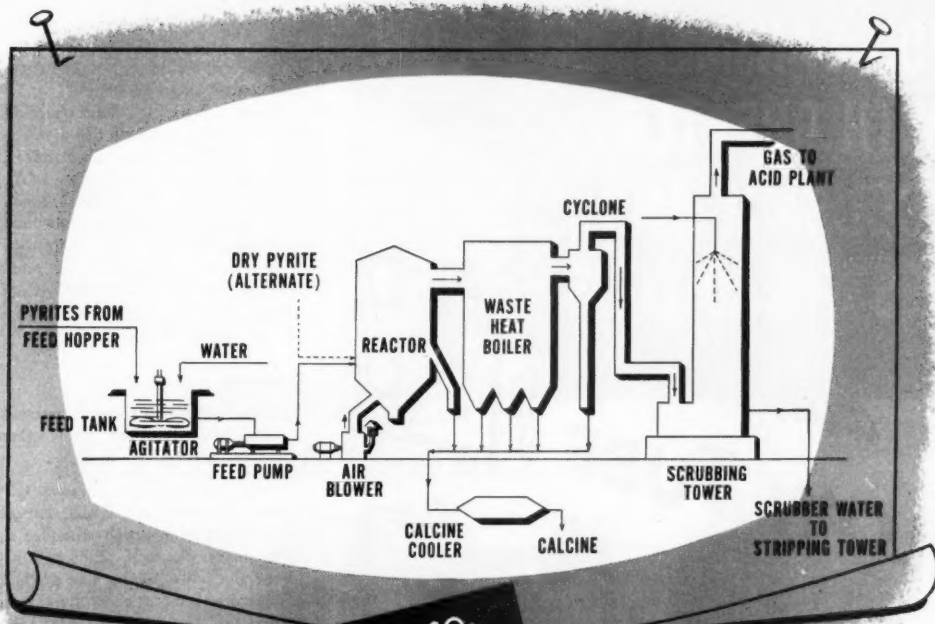
Electrical insulating film in a new form that can be fused into a coherent mass after application.

A new pressure-sensitive electrical tape, PTF, Type B, electrical insulating film, is made from unfused Teflon resin is a flexible, stretchable form.

The new type film is expected to find wide use for Class H insulation on conductors, coils, condensers, transformers and other installations operating at high temperatures, frequencies, and voltages.

Dielectric strength after fusing is more than 1,000 v. per mil. Moisture vapor transmission is less than 1/10 gm. per 100 sq. in. over a period of 24 hr.

In the manufacture of printed cir-



**Now...HIGH STRENGTH SO₂
and accurate temperature control**

... with the Dorco FluoSolids System.*

Sulphuric acid manufacturers faced with a shortage of elemental sulphur are finding in FluoSolids an economically feasible means of tapping sulphides as an alternate source of SO₂. Fifteen FluoSolids Systems are now under construction to furnish SO₂ gas for contact acid plants.

For detailed information about FluoSolids — a distinct departure from conventional roasters — ask for a copy of Dorco Bulletin No. 7500. Just write to The Dorr Company, Stamford, Conn., or in Canada, The Dorr Company, 80 Richmond St. West, Toronto 1.

*FluoSolids is a trademark of The Dorr Company, Reg. U. S. Pat. Off.

Facts on FluoSolids Systems for SO₂ Production...

Gas Strength will average 10-15% SO₂ from pyrite and other sulphides.

Gas Cleaning Equipment is smaller than with conventional methods.

Feed can be coarse or very fine — dry or wet.

Low Maintenance because no moving parts are exposed to high temperatures.

No Extraneous Fuel Needed once calcining temperature is reached.

Complete Instrumentation minimizes the "human factor" in operation.

Better tools TODAY to meet tomorrow's demand



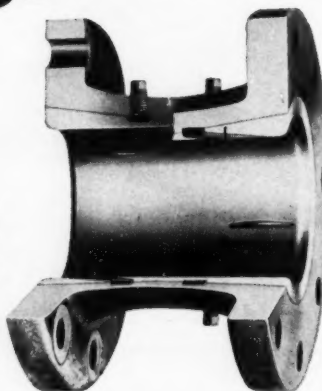
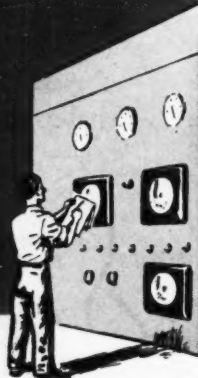
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WORLD - WIDE RESEARCH • ENGINEERING • EQUIPMENT

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YOU CAN MEASURE FLOW WITH GREATER ACCURACY AND LESS HEAD LOSS

with the **FLOW TUBE** (Gentile Patents)



To insure maximum combined accuracy of primary element and receiver, each Flow Tube is furnished with an individual head capacity curve (Flow Tube discharge coefficients cannot be obtained by calculations). For unusual piping arrangements, calibration test curves for simulated conditions are furnished.

To keep pumping costs at a minimum, the Flow Tube is made in four principal types for various media and main line velocities. This makes it possible to select the one best suited to the medium and the velocity of the flow, so that the differential produced is accurately measurable with the least pressure loss.

When you also consider the fact that the Flow Tube is so much easier to handle and install, because it is so much shorter and weighs so much less than the conventional venturi, it is clear why it is being increasingly used in a wide range of services. For further information on the Flow Tube, ask for Bulletin FT-101; and if you would like specific recommendations, please give us the processing and installation details of your metering requirements.

FOSTER ENGINEERING

Small Bulletin Summary *Company*
PRESSURE REGULATORS... RELIEF AND BACK PRESSURE VALVES... CUSHION CHECK VALVES...
ALTITUDE VALVES... FAN ENGINE REGULATORS... PUMP GOVERNORS... TEMPERATURE
REGULATORS... FLOAT AND LEVER BALANCED VALVES... NON-RETURN VALVES... VACUUM
REGULATORS OR BREAKERS... STRAINERS... SIRENS... SAFETY VALVES... FLOW TUBES

PRODUCT NEWS, cont. . .

cuits its high mechanical shock resistance enables it to be used where ceramic-base materials cannot.

Because of its high conformability and its ability to pull down when fused, the Type B film offers several advantages of pre-fused films. Air entrapments are eliminated between wraps, a better moisture resistant bond is provided between layers along with higher dielectric strength where more than one layer is used.—Minnesota Mining and Mfg. Co., 900 Fauquier St., St. Paul 6, Minn.

Cement

For bonding of foamed materials to themselves and many other substances.

Unlike conventional adhesives, CD Cement 200 will not, it is said, damage the thinnest honeycomb structure or cause shrinkage which results in a distorted and weak bond. The product has been designed to allow Styrofoam, Strux or cellular cellulose acetate and similar foamed products to be bonded securely and permanently to themselves or to wood, glass, metal and leather.

This product has a high solids content and is extremely tough. It is nonstaining and clear so an excessive application does not produce a messy appearance.

Fast setting, it does not require heat, pressure or any special surface preparation. It is only necessary to apply a thin coat to one surface and allow to dry for a few seconds before joining. It dries to a tough, durable, nontacky coating.—Chemical Development Corp., Danvers, Mass.

Trioxane, an essential solid fuel for heating field rations of military forces, has gone into large scale production at Bishop, Tex. The unit is the first of its kind to be built in the world.—Celanese Corp. of America, 180 Madison Ave., New York 16, N. Y.

New trade mark, Opalon, has been given to resins and compounds of the vinyl chloride family by Monsanto. Formerly all vinyl chlorides were classified as Ultron. Vinyl chloride film and sheeting will still be referred to as Ultron-Plastics Division, Monsanto Chemical Co., Springfield, Mass.

IN STORAGE . . .

OR IN TRANSIT . . .

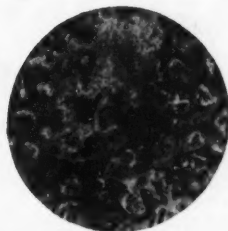


SIMPSON MIXED MATERIALS *STAY MIXED*

THIS you can depend on. Once materials are mixed in a SIMPSON Mix-Muller *they stay mixed!* Even after prolonged storage . . . or bouncing around in transit . . . where *conventionally mixed* materials tend to *segregate* or *stratify* . . . Simpson-mixed materials retain their *constant stability*.

Segregation can occur only where materials have been improperly mixed . . . where individual grains have merely been placed *next to each other*. Contrast this to *mulling* in a Simpson Mix-Muller, where *each grain* is subjected to a kneading, smearing, mulling action which actually *blends* component materials into *one* . . . where blending is intimate, thorough and uniform.

In addition, SIMPSON Mix-Mullers require less labor, less horsepower, and are safer to operate. You can obtain more information from a National Engineer. Write for details today.



(ABOVE) Conventionally mixed material showing typical smears of unmixed materials. (BELOW) Simpson mixed material showing complete uniformity of mix—which will remain in that form even in transit, or after long storage periods.



DO YOU REALLY KNOW WHAT MULLING IS?

Watch the practiced technique of a chemist's mortar and pestle — the intensive rubbing and smearing actions — and basically, **THAT'S MULLING!**

Mulling with a SIMPSON Mix-Muller utilizes a special pair of revolving mullers and plows mounted on a stationary pan. The mullers are adjustable and are supported by rocker arms. This leaves the mullers free to ride on the material creating a true mulling action as they revolve. The results are thorough, more accurate blending . . . unaffected by rough handling in transit, or in long storage periods.



SIMPSON

See Mulling Demonstrated in Booths 233-234 at the
1952 Chemical Exposition, Chicago—September 9-15



CORROSION affects every plant in the Chemical Industry

MILLIONS OF DOLLARS ARE LOST ANNUALLY

1 Your Hard-to-Get Equipment

... may be ruined by constant attack of acids, alkalis, fumes, chemicals, moisture, gases and weathering.

2 Your Valuable Products

... are subject to contamination and loss whenever they are in contact with corroded surfaces.

3 Expensive Shutdowns

... and loss of production with costly man-hours for repairs may be incurred unnecessarily.

4 Your Profits

Ruined equipment, contaminated products, the loss of production and repair expense caused by shutdowns mean only one thing... reduction in *your* profits!

RIGHT NOW... you should investigate the economies of using Amercoat; a line of coatings built to protect against *specific* industrial corrosion hazards.

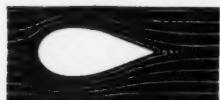
Our field engineers are available...without obligation...to check your plant for corrosion problems...and to give you *specific* recommendations.

AMERCOAT CORPORATION

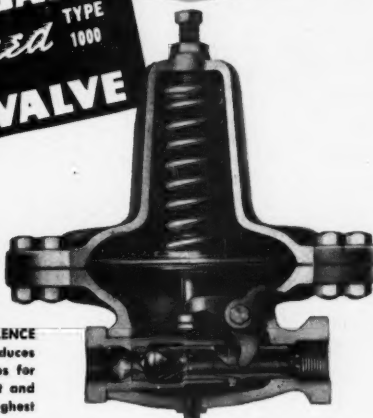
5800 WILSON BLVD., SOUTH GATE, CALIFORNIA

YOU SAVE MONEY *All Along the Line . . .* OVER YEARS OF SERVICE

CASH STANDARD TYPE 1000
Streamlined
PRESSURE
REDUCING VALVE



THIS FLOW PATTERN MEANS NO TURBULENCE
The Streamlined form of the inner valve produces the flow pattern shown above which makes for maximum capacity when it is needed most and permits accurate pressure control under toughest working conditions.



"Cheap in cost in the long run" is the way they describe this CASH STANDARD "1000"—the valve with the straight line flow that gives you close delivery pressure control—accurate regulation, and greater capacity. You save money all along the line over years of service because of smooth operation and continuous performance. You

have no production stoppages or product spoilage due to valve inefficiencies and there's practically no maintenance required. "Put the '1000' on the line and forget it" is another general expression of users. Investigate now and see why you can cut valve cost expenditures and at the same time get "tops" in performance.

Bulletin 962 features the CASH STANDARD Streamlined Type 1000 Pressure Reducing Valve—illustrates the streamlined construction and tells why you get exceptionally long, trouble-free, low-cost performance. Points out why you get no turbulence and therefore can meet peak demand at all times. Explains why straightline flow gives you maximum capacity, close delivery pressure control, and tight closure.

CASH STANDARD
CONTROLS..
VALVES

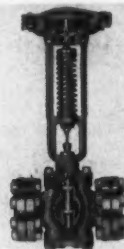
A. W. CASH COMPANY
DECATUR, ILLINOIS

**BULLETINS
AVAILABLE
ON OTHER
CASH STANDARD
VALVES**

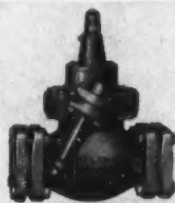
Send for them



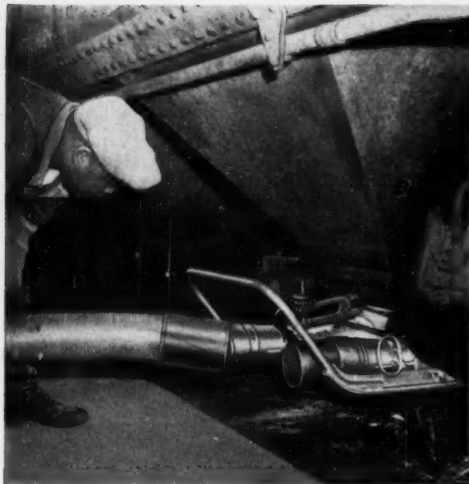
Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers—various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.



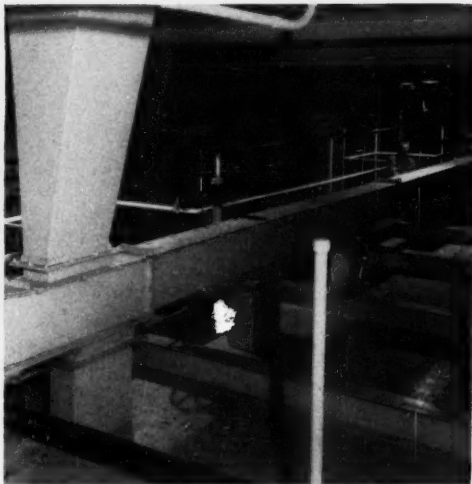
Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve—direct operated—direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.



Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve—designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



1 Pneumatic conveyor being hooked on to freight car hopper preliminary to unloading corn sugar.



2 Top view of V-shaped storage bins for corn sugar. Screw conveyor distributes the sugar to the various bins.

Sorbitol and Derivatives

A VAILABILITY of sorbitol has been greatly increased by a recent expansion of production facilities. The accompanying pictures of these facilities were taken at the Wilmington Works of the Atlas Powder Co.

Atlas began to make sorbitol in commercial quantities in 1937 by a batchwise electrolytic reduction process which also produced mannitol, an isomer of sorbitol.

In 1947 the electrolytic process was replaced by the present process involving catalytic hydrogenation.

Sorbitol is a hexahydric alcohol with characteristics similar to those of glycerine. In many ways, it is superior to glycerine and vastly more versatile. Moreover, it costs less than either byproduct or synthetic glycerine in humectant (moisture-conditioning) applications and in other ways. This trend is further accelerated by the decline of soap production (due to the encroachment of detergents) and the effects of the Korean War, which have combined to reduce the supply of glycerine and to increase its cost. Sorbitol now is at its lowest price in history.

Illustrative of the diversified applications of sorbitol and related polyols, made possible by their unique physical and chemical characteristics, are the following:

Explosives—Partially replacing glycerine in some commercial explosives.

Tobacco—Replaces glycerine pound for pound as a conditioner (or humectant).

Alkyls—Can replace up to 50 percent glycerine and 25 percent pentaerythritol. Makes better alkyls and results in coatings with excellent drying rates, improved gloss, adhesion, film toughness and durability. One of the fastest growing fields for sorbitol.

Cellophane and Regenerated Cellulose Products—Replaces portion of glycerine required.

Chief raw material in the manufacture is corn sugar. Nickel catalyst is mixed with the sugar solution and the slurry is pumped through a series of reactors at a pressure of approximately 125 atm. Hydrogen to reduce the sugar is circulated through the reactors. Reacted slurry and excess hydrogen discharge into a separator. Spent catalyst is removed from the sorbitol solution by pressure filters.

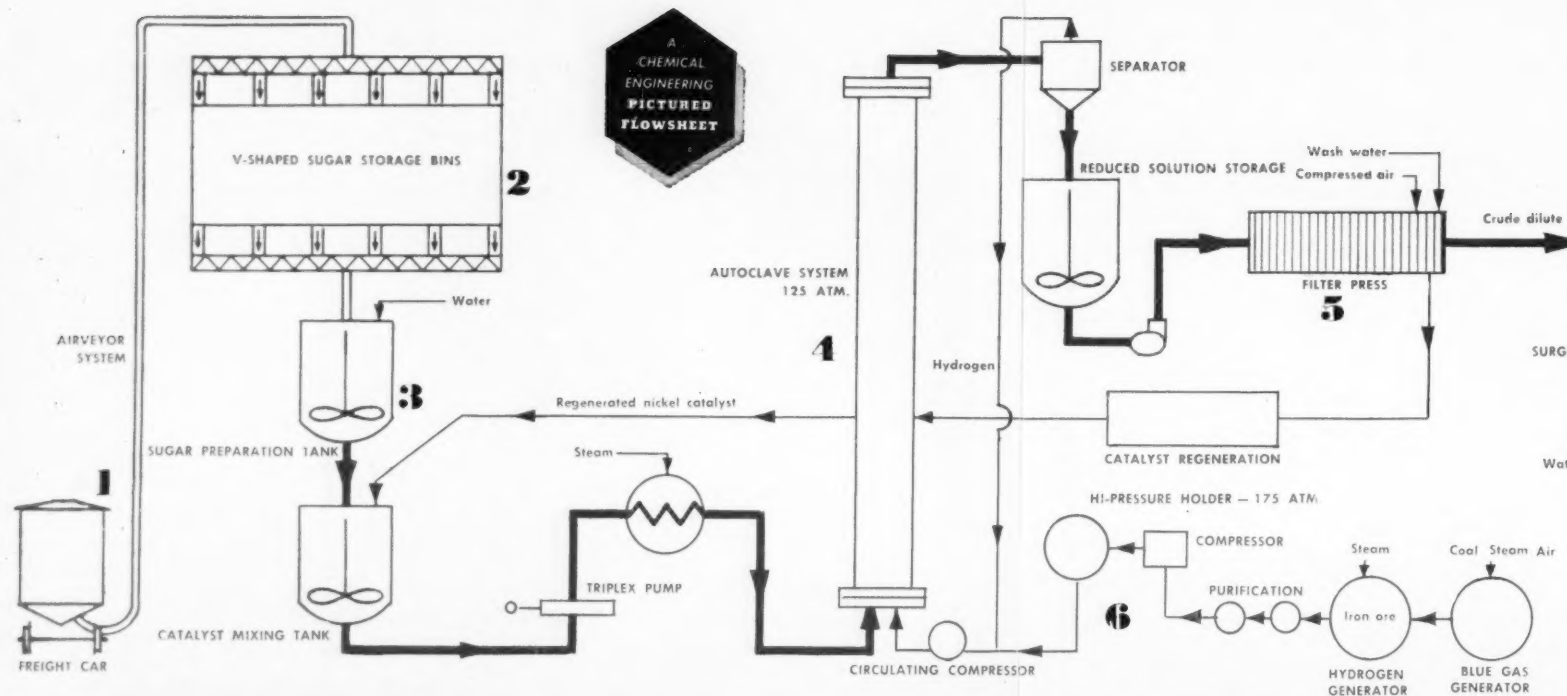
Rest of the process is devoted to purifying the sorbitol solution by ion exchange, treatment with Darco activated carbon, and evaporation and adjustment to final concentration.

A process has been developed for the conversion of the aqueous solution to a crystalline solid. As in the electrolytic process, appropriate adjustment of operating conditions permits the production of mannitol and sorbitol, as well as a non-crystallizing mixture of polyhydric alcohols which is sold as an aqueous solution.

When mannitol is made, it is separated from the other polyols by crystallization, and is purified by further recrystallization from water.

Atlas is its own biggest customer for sorbitol. Several derivatives are made by Atlas at the Wilmington Works from sorbitol. Most important are a series of partial esters of sorbitol anhydrides and the common fatty acids. Of equal importance are another series of surface active agents formed by condensing polyoxyethylene chains at the non-esterified hydroxyl positions of the partial esters.

Photographs 4 and 5 courtesy of Minneapolis-Honeywell Regulator Co.



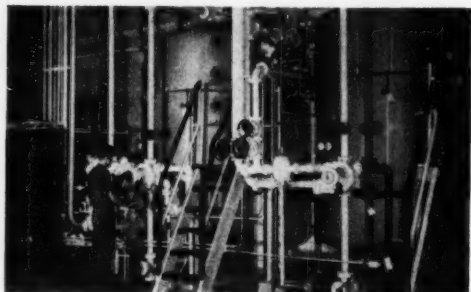
3 Sugar dissolver is an agitated vessel which takes in sugar from the storage bins and mixes it with water.



4 Autoclave system operates at about 125 atmospheres in catalytically hydrogenating the sugar to sorbitol.



5 Leaf-type pressure filter separates spent nickel catalyst from crude dilute sorbitol solution.



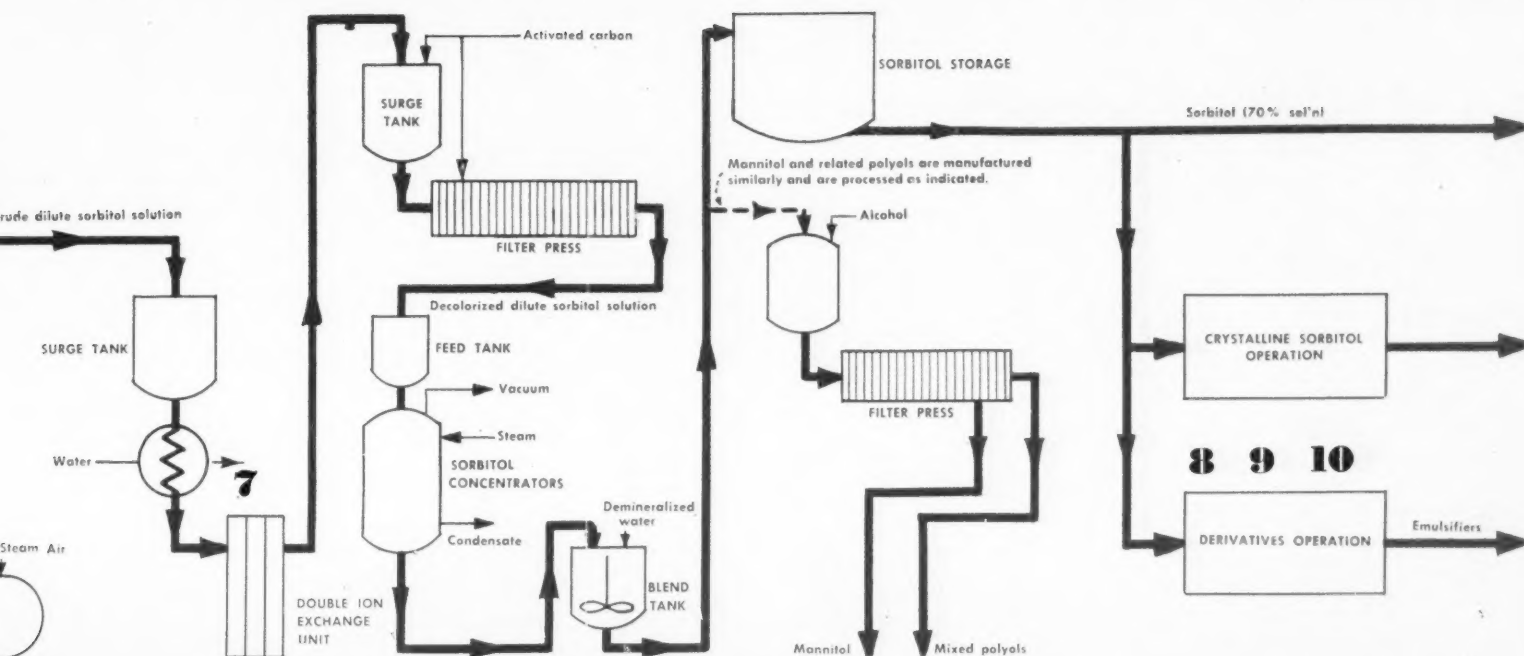
7 This double ion-exchange unit purifies the sorbitol solution before decolorizing and concentrating.



6 B h



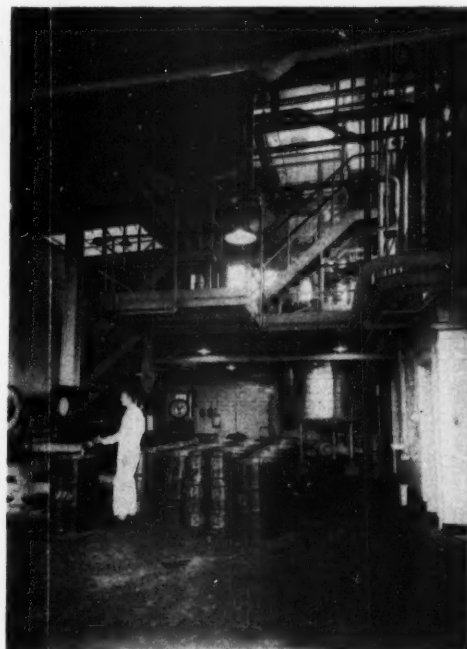
8 R ac



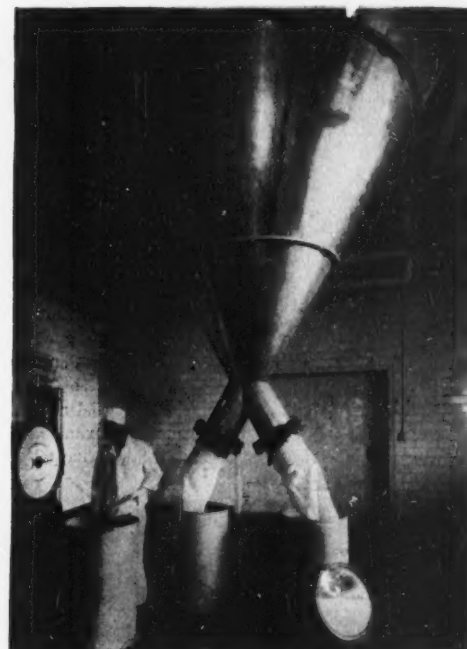
6 Building in which hydrogen is produced for the catalytic hydrogenation of corn sugar in the autoclave system.



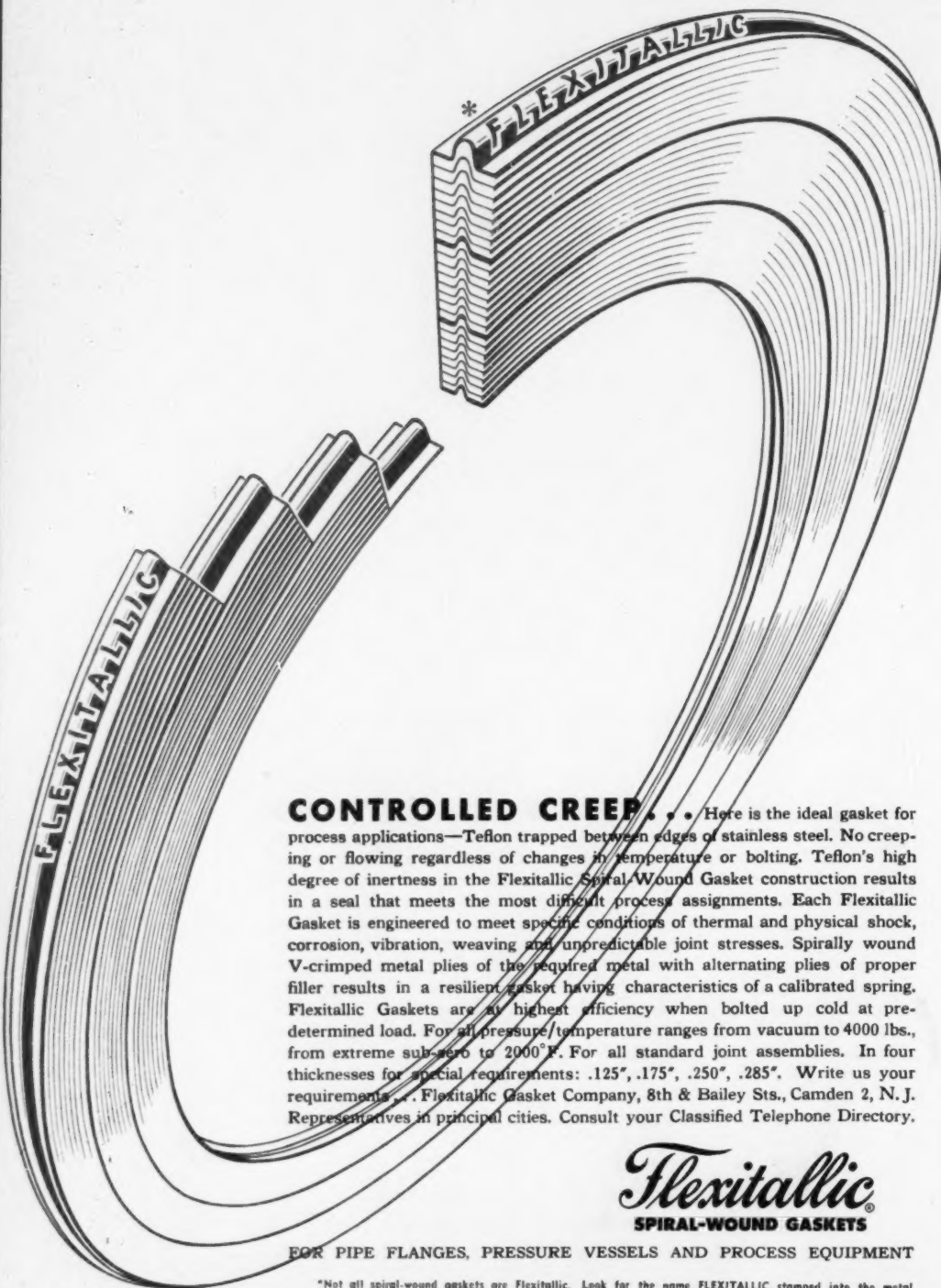
8 Reaction kettles for esterifying sorbitol solution with fatty acids to form a series of emulsifiers.



9 Building where the esters are further reacted with ethylene oxide to form a second series of emulsifiers.



10 Spray tower which makes small waxy solid particles of those emulsifiers which are sold in solid form.



CONTROLLED CREEP... Here is the ideal gasket for process applications—Teflon trapped between edges of stainless steel. No creeping or flowing regardless of changes in temperature or bolting. Teflon's high degree of inertness in the Flexitallic Spiral Wound Gasket construction results in a seal that meets the most difficult process assignments. Each Flexitallic Gasket is engineered to meet specific conditions of thermal and physical shock, corrosion, vibration, weaving and unpredictable joint stresses. Spirally wound V-crimped metal plies of the required metal with alternating plies of proper filler results in a resilient gasket having characteristics of a calibrated spring. Flexitallic Gaskets are at highest efficiency when bolted up cold at predetermined load. For all pressure/temperature ranges from vacuum to 4000 lbs., from extreme sub-zero to 2000°F. For all standard joint assemblies. In four thicknesses for special requirements: .125", .175", .250", .285". Write us your requirements... Flexitallic Gasket Company, 8th & Bailey Sts., Camden 2, N. J. Representatives in principal cities. Consult your Classified Telephone Directory.

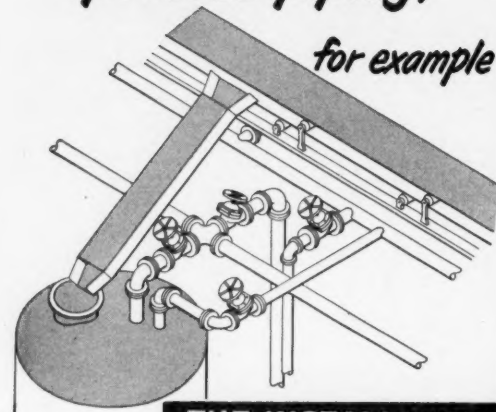
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SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Not all spiral-wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for Flexitallic Blue in gaskets with asbestos filler.

How to Reduce High in corrosive process piping,

for example



THE INSTALLATION

On steepwater solution lines to steam-heated steeping tanks at American Maize Products Co. plant, Hammond, Ind.

THE HISTORY

This plant had a problem of continual nuisance and cost of frequent valve re-packing. The valves then being used in steepwater lines were subject to constant leakage and rapid wear under exposure to the weak acid vapors present in the steeping process.

The problem was solved by replacing with Crane Iron Body Packless Diaphragm Valves. Even after 4 years' continuous service, these Crane valves required not a penny's maintenance cost—showed no leakage, no sign of corrosion, erosion, or undue wear. Already, Crane Diaphragm valves have given more than double the repair-free service obtained from any other valve used.

The Complete Crane Line Meets All Valve Needs. That's Why,
More Crane Valves Are Used Than Any

CRANE VALVES

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING

CHEMICAL ENGINEERING—August 1952

High Valve Costs

VALVE SERVICE RATINGS

SUITABILITY:

Packless feature good

MAINTENANCE COST:

None in 4 years

CORROSION-RESISTANCE:

No sign of Corrosion

SERVICE LIFE:

No sign of wear - looks indefinite

OPERATING RESULTS:

Excessive costs eliminated

PRICE:

Moderate - much less than alloy valves

AVAILABILITY:

Stock item in Crane line

THE VALVE

Crane No. 1611 Iron Body Packless Diaphragm Valves, featuring separate disc and diaphragm design. Diaphragm used to seal bonnet and stem only; is not subject to crushing and rapid wear. Separate disc insures positive seating even should diaphragm fail. Available with Neoprene diaphragm and disc insert, or fully Neoprene lined. See your Crane Catalog or Crane Representative.



ALVES

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Industrial Areas

BING • HEATING

213

HOW Flash Drying



removes COMBINED MOISTURE

Copper Sulphate Crystals dehydrated and pulverized into finely powdered mono-copper sulphate by the Imp Mill Flash Drying System.

The use of Flash Drying with the Raymond Imp Mill is an effective method of extracting chemically combined moisture, such as water of crystallization, from various hydrate compounds like copper sulphate (blue vitriol), calcium sulphate (gypsum), zinc sulphate, aluminum sulphate and others.

A typical example is the processing of copper sulphate. This material in crystal form contains five molecules of water, part of which is driven off at a certain temperature while the material is being pulverized.

The heat in the system is controlled to the proper degree, so as to liberate four of the five molecules of water, producing a uniform mono-copper sulphate. This is pulverized in the mill to a fine, dry, free-flowing, blue white powder of uniform quality, testing 99% or better passing 325 mesh.

The use of the Imp Mill, arranged to dry and grind your material simultaneously, offers the greatest possible production cost savings, because it combines two operations in one. Flash Drying is applicable to many materials. If you have a drying-grinding problem, Raymond Engineers will be able to help you.

RAYMOND
Flash Drying
CATALOG No. 54A

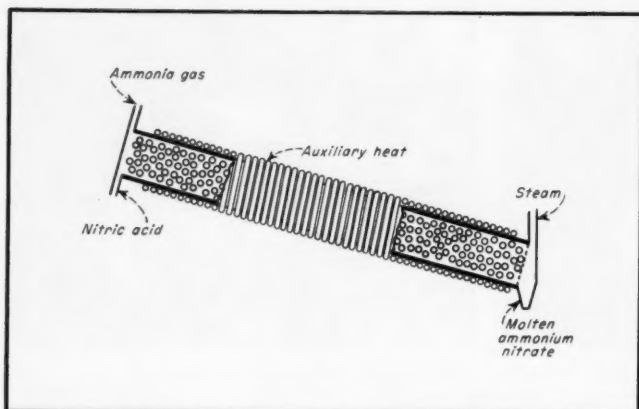
COMBUSTION ENGINEERING - SUPERHEATER, INC.
Raymond
PULVERIZER DIVISION

1311 NORTH BRANCH ST.
CHICAGO 22, ILLINOIS

SALES OFFICES IN
PRINCIPAL CITIES

214

August 1952—CHEMICAL ENGINEERING



REACTOR: Simple jacketed tube packed with glass beads or rings.

One Step Ammonium Nitrate

New process turns out dry, molten ammonium nitrate. Key: acid, ammonia reacted in vapor phase. Reaction heat evaporates water. Result: one-step process.

Conventional processes for the production of dry ammonium nitrate leave something to be desired.

That something is engineering economy. Here's why:

Nitric acid is first reacted with ammonia, giving a solution of ammonium nitrate in water. The reaction is highly exothermic, and most of this heat is lost. Next you must evaporate most of the water before you can prill, crystallize or grain the product. For this evaporation you have to supply heat from a new source. Then you have to dry the finished product.

► **Limiting Factor: Safety**—Each of these operations is carried out in widely scattered equipment of limited capacity. This because of the explosion hazard of molten ammonium nitrate.

It isn't hard to see that the ideal way to make ammonium nitrate of any moisture content would be to react the ammonia and nitric acid at a high enough temperature to produce molten nitrate directly. The heat given off by the exothermic reaction, if confined, could evaporate, simulta-

neously, the desired amount of water. But any such process must be made safe to operate.

► **CSC Licks Tradition**—Commercial Solvents Corp. has now done just that. They've developed a one-step, continuous process that turns out molten ammonium nitrate—and safely too.*

After a year in the pilot plant at Sterlington, La., the company is erecting a commercial plant at the same site to use the new process. The new plant should be on stream within a year.

Leonard A. Stengel, an authority on the high-pressure synthesis of ammonia and methanol, developed the process which will bear his name. (Stengel, incidentally, is a synthetic methanol man from way back—in 1926 he started up Commercial Solvents' pioneer plant at Peoria.)

Process consists essentially of passing a mixture of approximately equimolecular proportions of nitric acid and ammonia in intimate contact

through a reactor tube at a temperature between 180 and 250 deg. C.

The reactor, of course, must be constructed of material resistant to nitric acid and ammonia liquids and vapors (probably stainless steel). It can operate in either a vertical or inclined position. Stengel says that the inclined position is preferred, though, to facilitate draining of the liquid product.

The reactor is packed with Raschig rings or glass beads. The packing promotes good mixing and assists in temperature control. It no doubt has a lot to do with reducing the explosion hazards too.

By utilizing all of the heat given off by the reaction and adding whatever additional heat is necessary to keep the reactor between 180-250 deg. C., the reaction products are removed in two phases: steam and molten ammonium nitrate. The additional heat usually required may be supplied by means of a steam or oil jacket surrounding the reactor or by electric resistance heaters.

► **Process Plenty Flexible**—Pilot-plant experiments have successfully used nitric acid ranging from 20 to 100 percent HNO_3 content, and ammonia vapors at about 220 deg. C. In these runs, a reactor 8 in. in diameter and 36 in. long turned out 24.5 lb. substantially dry product per hour.

Although size of the commercial unit has not been disclosed, best guess is about a 4-6 in. diameter and 6 ft. long. Small holdup in the reactor is a big safety feature.

The molten product leaving the reactor is essentially water-free and may be flaked, prilled or grained; or it may be cooled in block form and subsequently crushed or milled.

If a greater water content is desired in the product, it is easy to turn out solutions as such, simply by lowering the reaction temperature to prevent evaporation of all the water.

For example, if you want a 65-70 percent ammonium nitrate solution, you use nitric acid of about 60 percent concentration and ammonia vapor, both at atmospheric temperatures. No external heat is added and the resulting aqueous product is collected as usual.

* U. S. Pat. 2,568,901.



EARLY MILLS had one side and roof of light frame construction to direct possible explosions towards creek.

Happy Birthday!

One hundred and fifty years young, Du Pont seems to have found the corporate fountain of youth.

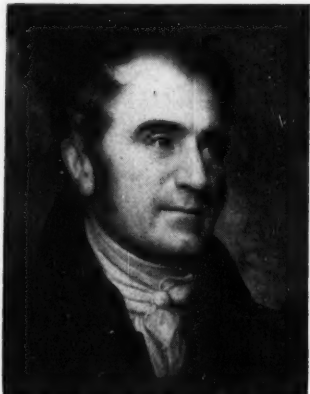
On July 19, 1802, Eleuthere Irenee du Pont arrived at a previously selected site on the banks of Brandywine Creek to put up a gunpowder mill.

Last month nearly 7,000 Du Ponters gathered at the same spot, a few miles from company headquarters, to celebrate their 150th birthday.

The Du Pont story could fill a book. In fact, it does. The company has just published a handsome masterpiece, chock full of superb illustrations.

Life hasn't always been a bed of roses for Du Pont. The original founder was plagued all his life with a shortage of liquid capital. And even as late as 1902, just a few months before the company's 100th anniversary, the owners decided to sell.

But three young Du Ponts came through with a bold and daring rescue, and the Du Pont Company now seems to have an excellent chance of living happily ever after.



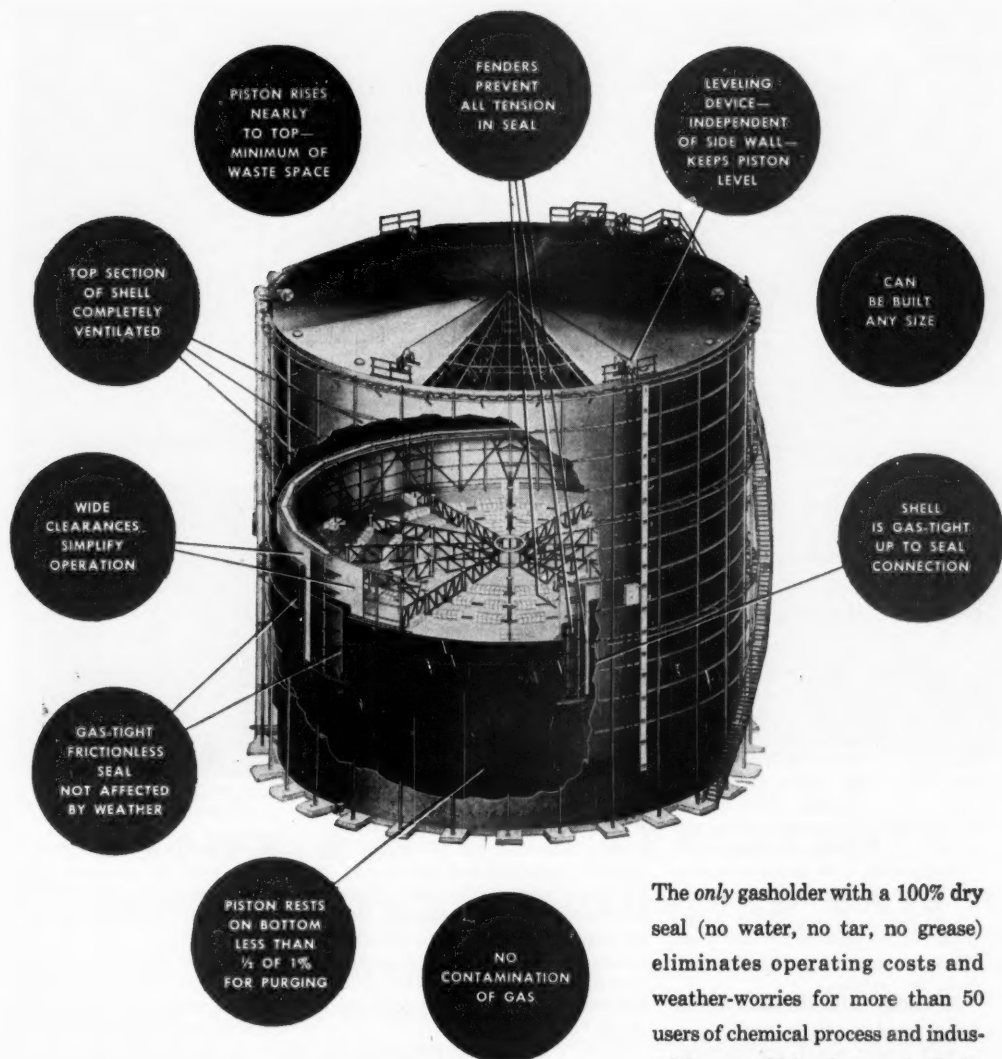
E. I. DU PONT: Namesake lives on.



FIRST OFFICE was in original Du Pont residence.



PRESENT headquarters occupies two large buildings.

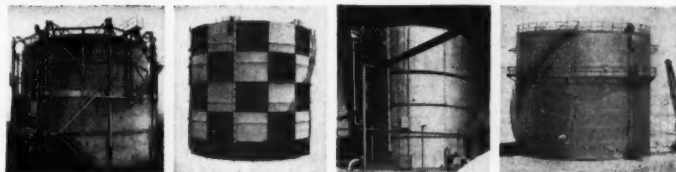


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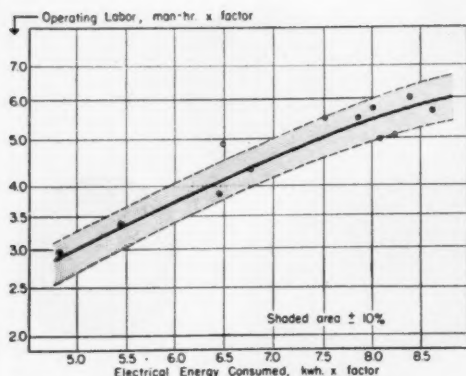
GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South La Salle Street

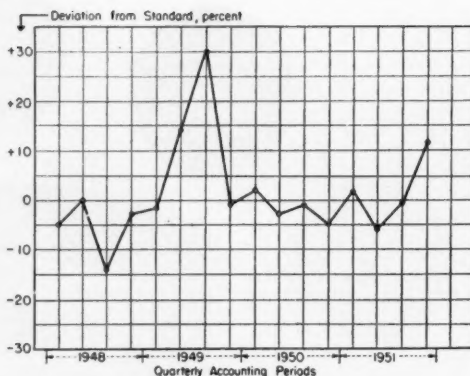
Chicago 90, Illinois

OFFICES IN PRINCIPAL CITIES

In Canada: Toronto Iron Works, Ltd., Toronto, Ontario



STANDARD CURVES are based on past experience.



PERFORMANCE chart spotlights off-standard operations.

New Way to Control Costs

Standard curves based on kwh. consumption are the key to better control of manufacturing costs. They make budgeting of future costs easier, more accurate.

Several years ago David E. Pierce, General Aniline's chief engineer, introduced a new way to budget and control maintenance costs in chemical plants. Now he proposes to extend this to the control of raw material cost, operating labor hours, steam and water consumption, and other manufacturing cost elements.

Pierce uses as a common denominator for measuring plant activity the number of kilowatt-hours of electrical energy consumed by the plant. All other costs can be related to kwh., he explains.

According to Pierce, these are the objectives of his new system:

- To relate actual manufacturing costs, as determined by the plant accounting department, to standards previously established, so that performance can be measured for any desired period.

- To provide a variable budget for predicting costs in future periods.

► **Standard Curves**—The system requires that you first prepare a set of standard curves, based on historical operating records. Such a curve for operating labor is shown above.

In the case of steam consumption, the ordinate would be lb. of steam per kwh. plotted against the corresponding degree-days for each quarterly period. The number of degrees below 65 deg. F. for each day are

added together to give the total degree-days for the quarter.

For water consumption another kind of seasonal correction is made; here you plot cu. ft. per kwh. vs. average water temperature for the period.

► **Cost Control and Budgets**—Data for the various items are tabulated monthly as received from the accounting department. For each three months, the results are compared with the values predicted by the standard curves for the actual kwh. consumption during that quarter. Deviations are expressed as percent of predicted amounts.

Pierce considers a variation of 6 percent within the precision of the method. Within these limits, no explanations would be necessary.

The second chart above represents the actual performance of a certain plant. According to Pierce, the off-standard figures were all explainable to management's satisfaction.

To prepare a budget for future periods, you use the same standard curves. However, in order to forecast the electric power consumption, you must have the relation between pounds or other units of production and kwh. This is because the only direct data available for the future period will be the estimated quantities of goods to be produced.



DAVE PIERCE:

Will tell all come October.

In some cases, total plant production vs. kwh. follows a smooth curve; in other cases, you must develop curves for each manufacturing unit or product.

► **More Data to Come** — Although Pierce has discussed his ideas privately with several production managers in various companies (most of them were anxious to try it out), he made his first semi-public presentation of the method to a student group at Columbia University. He will give a full-blown exposition at a symposium of the New York section of the AIChE on October 21.

In the meantime, Pierce is busy collecting more data. "This whole thing is like a picture puzzle," he says. "The pieces keep falling together as I get more and better information."

And anyone who can make the puzzle of cost control and budgets fall into a finished picture may well find himself in the position of the inventor of the proverbial better mousetrap.



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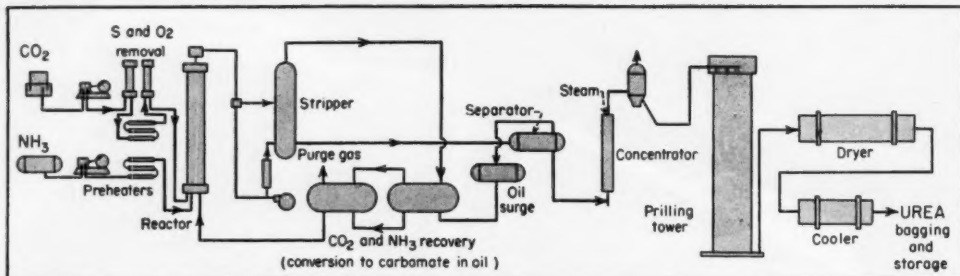
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Pechiney oil-slurry recycle process, eye-catcher among incipient urea-producers, cuts down corrosion, energy consumption.

Urea Picture Fills Out

At least four U. S. companies plan to put up urea plants shortly. Two are considering foreign processes; one is set on France's Pechiney process.

A whole fistful of companies are currently preparing to plunge into the urea business.

Allied Chem & Dye, Cities Service, W. R. Grace and John Deere & Co. are all mulling over plans for urea plants. Up to now, the only U.S. manufacturers have been Du Pont and Allied. Du Pont started making urea in 1933 in conjunction with its ammonia plant in Belle, W. Va. Allied's South Point, Ohio, unit went on stream in 1950.

• Allied has just announced that they will build a \$25 million ammonia-urea plant at LaPlatt, Nebr. Construction is slated to get under way this summer. Completion is expected in 1½ to 2 yr. Natural gas will be the source of hydrogen. Company engineers have worked up what they believe to be a unique process (details of which they are not ready to disclose) for the new urea unit.

• Cities Service has a certificate of necessity for a \$28 million project in the Gulf Coast area to produce 100 tons a day of urea and 300 tons a day of ammonia. Decision as to what urea process to use is still up in the air.

• W. R. Grace is thinking of building a \$20-million ammonia-urea plant in the Midwest. Though uncertain as to choice of process, company engineers are paying particular attention to France's Pechiney process. Owned by Compagnie de Produits Chimiques et Electrometallurgiques, it has been

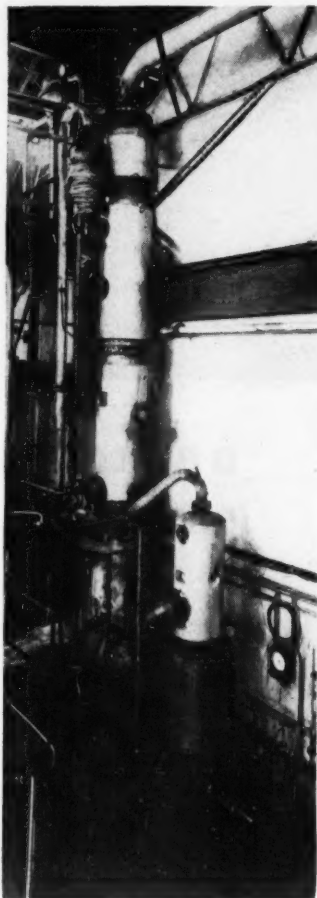
in use at their plant in St. Auban, France, for over ten years. Foster-Wheeler Corp., N. Y., has U.S. licensing rights.

• John Deere & Co. has settled on the Pechiney process for its urea venture. A \$18-21-million plant is slated for Pryor, Okla. For ammonia facilities: \$7-8 million; for facilities to convert ammonia into urea and urea-ammonia solutions: \$5-6 million. Rest of the money is for site, office, labs, working capital, etc.

Scheduled for completion early in 1954, the plant marks the debut of Deere, manufacturer of farm tractors and equipment, in the chemical industry. Though the company's first interest is the agricultural market, urea for plastics, adhesives and feed supplements is seriously considered for the future.

Plant's daily capacity of ammonia will be 180 tons. This can be turned into a maximum of 275 tons of urea (44 percent N) and 70 tons of urea-ammonia solutions (40 percent N). Deere expects to market fertilizer-grade urea in granulated or pelleted form containing a conditioning agent.

► **Why Pechiney?**—Deere will use the process as modified by Foster-Wheeler. French version of the process is geared for only 4 to 5-ton-a-day production and gives crystalline form. Foster-Wheeler upgrades to 200-300 tons, uses American-made equipment, adds prilling instead of crystallizing so urea is OK for fertilizer use. A lit-



Stripping column in French plant which makes urea via the Pechiney process.

tle further processing, they say, can give plastic-grade urea, if and when it is wanted.

An oil-slurry recycle process, like

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SELF-POLISHING FLOOR WAXES

EMULSION TYPE PAINTS

**PROPERTIES
OF PURE MATERIAL**

Molecular Weight.....	89.14
Melting Point, °C.....	30 to 31
Boiling Point, °C.....	165 at 760mm
Specific Gravity.....	0.934 at 20/20°C
pH at 20°C of 0.1M Solution.....	11.3
Vapor Pressure at 20°C.....	approx. 1mm
Flash Point (Tag. open cup).....	159°F
Solubility in Water g/100 ml at 20°C	completely miscible
Index of Refraction at 20°C.....	1.449

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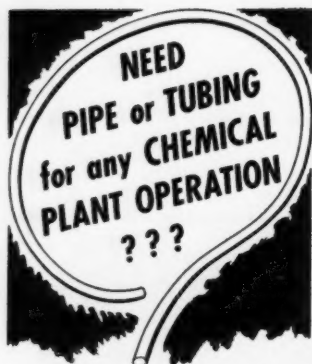
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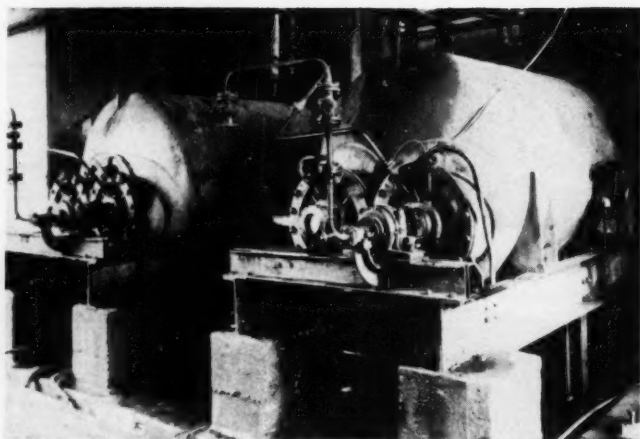
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NEWS, cont. . .



Carbamate oil-slurry formed in this reactor eases recycling in Pechiney process.

Pechiney, according to Deere, has the following advantages: Energy is conserved by pumping oil instead of recompressing gases; the oil is a good heat-exchange medium; it gives good corrosion protection for equipment; the process is self-contained—it does not have to run unconverted gases to another plant for recovery.

►How?—All urea processes use the same basic chemistry.* Ammonia and carbon dioxide react to form ammonium carbamate, a solid. The carbamate then loses a molecule of water to form urea. Equilibrium considerations, however, make it impractical to achieve complete conversion.

Unconverted carbamate reverts readily into ammonia and CO₂. Recycling of the mixed gas is a headache; at the pressures involved, solid carbamate is again formed and fouls things up. Du Pont, instead, recycles NH₃ and CO₂ in aqueous solution, but they run into corrosion problems and have to use very high reactor pressures.

The Pechiney process recycles solid carbamate as a slurry in a neutral mineral oil, effectively bypassing the difficulties of the other processes. Apart from its function as carrying vehicle for the carbamate, the oil also helps control reactor temperature.

►Where Will It Go?—Deere's and the other projects should cause a swell in already rising urea production. In 1940 output was 150 million pounds a year; in 1950, 300 million.

* See Chem. Eng., March 1951, p. 111.

Now it hits close to 400 million.

One important outlet is fertilizers. Nitrogen for the soil can be provided in one of its most concentrated forms through the use of urea. This, of course, lowers cost, facilitates shipping. Furthermore, it is easy to handle and readily assimilated by animals and plant leaves.

Its use is growing in urea-formaldehyde molding compounds and as a chemical intermediate and in specialties like ammoniated toothpaste, deodorant creams, solder flux.

Pennsalt to Get Premium Price for Cryolite

The largest U. S. producer of cryolite has just been granted a contract by the government that will double the nation's supply of cryolite. The Defense Materials Procurement Agency has agreed to buy 13,700 tons of refined cryolite from Pennsylvania Salt Manufacturing Co. at \$260 a ton.

DMPA will sell the cryolite it gets under this contract to U. S. aluminum producers at the going market price—about \$190 a ton. The government will absorb the \$70 difference. Cryolite is used in the electrolytic reduction of alumina to aluminum metal.

Purpose of the premium price, DMPA says, is to enable Pennsalt, the sole U. S. producer, to step up purchases of cryolite ore from the Danish company that mines the world's only commercial source of cryolite in Greenland.

Delaney Committee Urges Control of Food Chemicals

All four sections of the Delaney Committee report have now appeared, together with the committee's recommendations for amending the federal law to deal with chemicals in foods. The report comprises sections on fertilizers, cosmetics, foods and water fluoridation.

The Committee recommends that the Food, Drug and Cosmetic Act of 1938 be amended to require the same safety measures for chemicals used on or in foods as are now required for new drugs and meat products.

Adequate provision for a comprehensive judicial review of administrative decisions should, according to the Committee, be included in such an amendment.

Two of the seven members of the Committee appended separate comments in which they emphasized the importance of chemicals to food production, but stressed the importance of pre-testing as a consumer safety measure and educating the public to the dangers of newer sprays and insecticides.

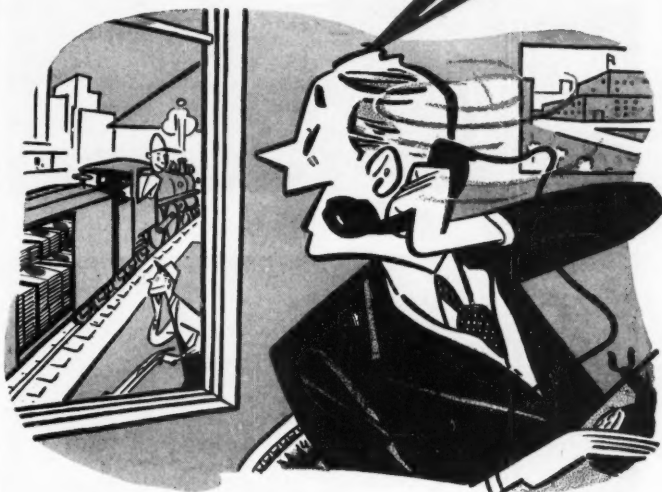
Two strong minority views stressed the "alarmist" nature of the majority report, and pointed out that the U. S. Public Health Service, the Food and Drug Administration and the Department of Agriculture are responsible agencies, doing good work in this field. Failure of the Committee to recognize this fact adequately led Representative Horan to conclude, "We need faith in government. We need both a feeling of security and encouragement in the hearts of our producers. We should assure the security of the consumer. Our government is doing that. Let us admit it."

In the food section of the report, seven specific chemicals are dealt with. All have been ruled out of foods in interstate commerce by the FDA within the last few years. Emulsifiers and hormones are also discussed.

Pesticide residues take up about 20 percent of the report. There is a long section on the use of chemical emulsifiers to replace natural food substances in baked goods.

Inadequacy of present legislation is covered in five pages. In conclusion, the Committee states that, "The increasing use of chemical additives in the production, processing, preservation, and packaging of food has created a serious public-health problem."

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CARLOAD OF MULTIWALLS. WHEN DO
YOU THINK... OH! HERE THEY ARE!
WHAT TOOK YOU SO LONG?



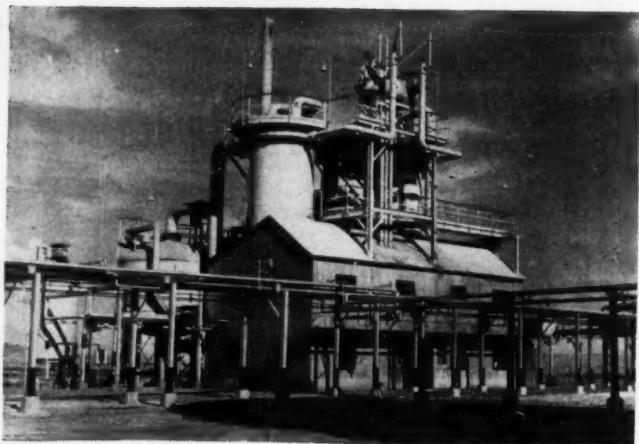
Don't pin us down to that, please. But, no fooling, the twelve Bemis multiwall plants, strategically located coast to coast, mean that at least one is conveniently close to you. This time-saving means money-saving. Ask your Bemis Man for details.



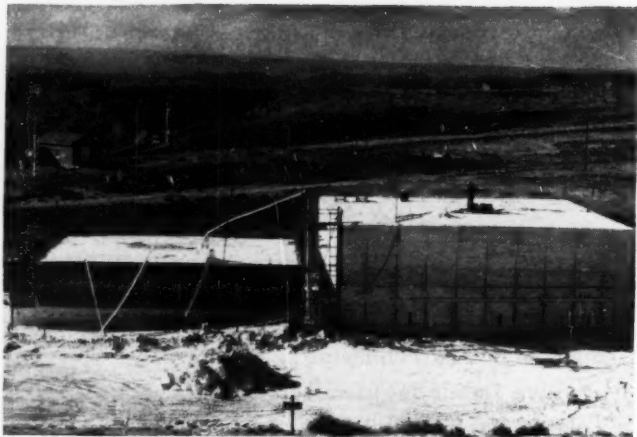
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Wyoming plant recovers . . .



40 tons per day of . . .

Sulphur From Sour Gas

The tumult and the shouting over the sulphur shortage die, but the day-by-day job of getting sulphur from every possible source remains. Typical of the effort being made is the recovery of sulphur from sour gas at the Elk Basin, Wyo., gasoline plant. Stanolind Oil & Gas Co. operates the entire Elk Basin unit for its 29 owners.

Each day, 40 long tons of commercial sulphur are recovered at the Elk Basin plant, using a modification of the Claus process, only recently developed for commercial use in the United States.

Gas produced at Elk Basin contains an excess of hydrogen sulphide. In most plants of this type, where valuable hydrocarbons are extracted from casinghead gas and the dry gas re-injected into the reservoir, the hydrogen sulphide extracted during sweetening is flared and vented to the atmosphere.

In the Elk Basin plant, however, the corrosive and toxic hydrogen sulphide becomes a source of badly needed sulphur.

The plant can extract hydrogen sulphide, carbon dioxide, gasoline,

butane and most of the propane from 12 million standard cubic feet per day of casinghead gas. It produces a fuel gas for plant boilers and compressors, a residue gas at 500 psi. for sale, commercial sulphur and non-corrosive boiler flue gas at 1,500 psi. for injection into the reservoir. Returning dry gas to the underground reservoir maintains pressure and adds to the productive life of the Elk Basin field.

In addition to the 40 tons of sulphur, the Elk Basin plant daily produces 12,000 gal. of propane, 13,500 gal. of butane and 13,400 gal. of gasoline.

New NBS Devices Measure Extremes of Temperature

Spurred by increasing need for reliable temperature measurements at both very high and very low temperatures, the National Bureau of Standards is extending its temperature standardization program toward the extremes of the temperature scale.

New instruments and methods of calibration are being developed for these regions, and research efforts are being directed toward the extension of the International Temperature Scale to provide greater accuracy and reproducibility in the measurements thus made possible.

Until recently, for example, standard platinum resistance thermometers were calibrated singly at the sulphur point, using apparatus open to atmospheric pressure. Now, however, as a result of NBS research, the use of pressure control has been extended to measurements of the sulphur point.

Previously, variations in atmospheric pressure had been both troublesome and a source of uncertainty in the measurements, and most determinations were being made at night because pressure variations are smaller during that period.

The new method uses a closed aluminum boiler having wells for 10 thermometers and connected to a precision manometer. This apparatus will make possible a study of the sulphur point as a precise fixed point for thermometry.

The Bureau is now working to get the closest possible agreement between the thermodynamic and the International Temperature Scale. To aid this work, a "noise thermometer," developed at the University of Chicago,



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CHEMICAL ENGINEERING—August 1952

225

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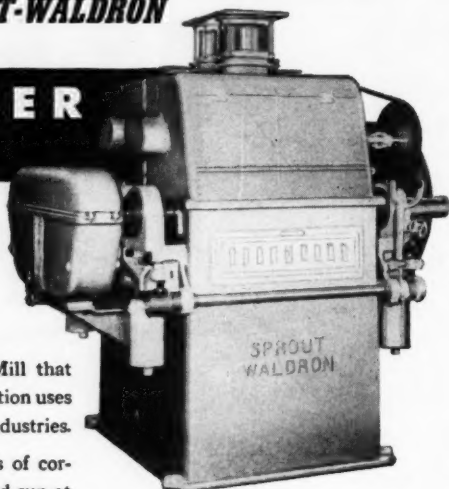
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News, cont. . .

has been set up at NBS to measure thermodynamic temperatures. The mean-square voltage due to thermal fluctuations in electron density in a resistor—usually called thermal noise—is a function of the thermodynamic temperature of the resistor. By comparing the noise voltages across two resistors at different temperatures, it's possible to determine the ratio of temperatures of the resistors. The first measurements will be made of the temperature of the gold point, important both for the thermocouple and optical-pyrometer ranges of the International Temperature Scale.

A search is now under way for a better material to substitute for the alumel wire of a chrome-alumel thermocouple. When used under conditions encountered in exhaust gases in aircraft engines, the alumel becomes brittle and fails after a relatively short period of operation. Substitutes for alumel that appear likely to withstand the vibration and corrosive atmosphere are being investigated to determine their performance under these extreme conditions.

A significant advance in the measurement of extremely high temperatures is the recent development of an iridium-iridium-rhodium thermocouple. Because of the high temperatures—up to about 3,800 deg. F.—that prevail in the primary burning zones of turbojet and ramjet combustion chambers, conventional temperature-sensing instruments are not suitable. So far, the new thermocouple has withstood both thermal and mechanical stresses incident to combustion-chamber operation, and heat-resistant supporting tubes and insulators are now being developed so the device can be used in flight.

At very low temperatures (below 50 deg. K.) NBS research has two major objectives: (1) determination of thermodynamic temperatures by a gas thermometer; and (2) development of convenient, sensitive and reproducible secondary thermometers that can be calibrated by the gas thermometer. Since development of a highly accurate gas thermometer is painstaking and time-consuming, the Bureau is concurrently pushing work on the secondary thermometer. Resistance thermometers of the semiconducting elements, silicon and germanium, have proved to be extremely sensitive; in some cases the resistance changes

more than 50 percent per degree. Reproducibility is still a problem, but initial tests have been promising.

LPG Odorized in Gas Phase By New Calva Process

A more effective method for odorizing liquefied petroleum gas has been developed by J. B. Calva & Co., a Minneapolis engineering firm. The method has proved highly efficient experimentally.

Normally, ethyl mercaptan is added to the liquid phase. However, the petroleum gas vaporizes much more rapidly than does the odorant, and at a temperature below 75 deg. F. a cylinder of liquid propane, for example, will be completely volatilized before the gaseous propane reaches the level of odorization of natural gas. Thus the purpose of odorizing is defeated.

The Calva process overcomes this difficulty by adding the odorant to the gaseous phase directly. A small cartridge of odorant is inserted into a specially provided cavity in the valve of the cylinder. In this way, liquefied petroleum gas gets a highly uniform concentration of odor and at a level of odorization comparable to that of utility service gas. The process can be used not only for bottled gas but for semi-bulk systems and central plants for gas utility service.

CONVENTION CALENDAR

National Agricultural Chemicals Association, annual meeting, Essex and Sussex Hotel, Spring Lake, N. J., September 3-5.

National Conference on Industrial Hydraulics, eighth annual conference, Sherman Hotel, Chicago, September 4.

Seventh National Instrument Conference and Exhibit, Cleveland Auditorium, Cleveland, September 8-12.

National Chemical Exposition, Coliseum, Chicago, September 9-13.

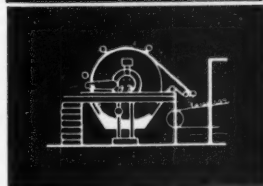
National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, September 10-12.

American Institute of Chemical Engineers, Palmer House, Chicago, September 11-13.

Packaging Machinery Manufacturers Institute, 20th annual meeting, The Homestead, Hot Springs, Va., September 11-14.

American Chemical Society, national meeting, Atlantic City, September 14-19.

Drug, Chemical & Allied Trades Section, New York Board of Trade, annual meeting, Pocono Manor Inn, Pocono Manor, Pa., September 25-28.



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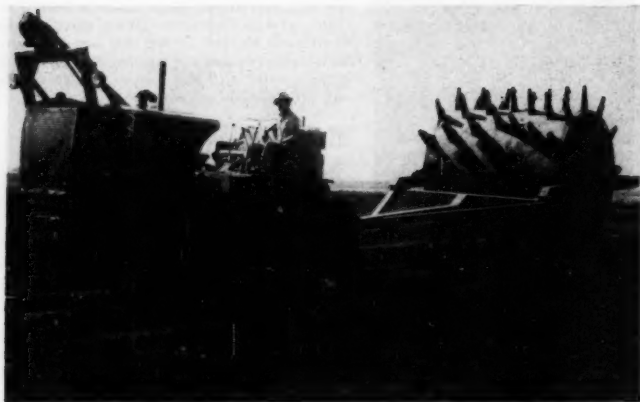
By INTEGRATED ENGINEERING we mean simply this—

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CHEMICAL METHODS of stabilizing soils for engineering uses.

Stabilize With Chemicals?

Chemical additives have their place in soil stabilization, but right now it's a minor one. Chemical engineers, however, are getting into the act.

Some 500 technologists from all over the world met recently in Cambridge* to swap ideas on soil stabilization.

Chemical people there were in for a shock. They learned that chemical additives play an almost negligible role in soil stabilization. Vast amounts of dirt have been stabilized, but almost none by chemical means. This was especially revealing in view of recent

publicity on chemical soil conditioners.

But the chemical profession did get a small—but definite—ray of hope. Soil stabilization, once almost exclusively the civil engineer's bailiwick, is moving into a no-man's land where the talents of many professions, including chemistry and chemical engineering, are beginning to break in.

The conference drew soil engineers, soil scientists, chemists and chemical engineers, representing equipment manufacturers, chemical companies,

all branches of the Armed Forces and many other groups and agencies. The three-day session, which included some 30-odd prepared papers and discussions, was high-lighted by many informal arguments on all phases of the subject.

► **Rapid Cross-Fertilization** — With such a heterogeneous group, the rate of exposure to unfamiliar material was tremendous. Civil engineers and contractors heard about ionic and covalent bonding, polymerization and polynuclear coordination complexes; chemists and chemical engineers learned of intergranular stress, angles of internal friction, plastic indexes, liquid limits and other terms common in soils engineering.

Soil stabilization was broadly defined as any method of treating unsatisfactory soil to make it more suitable for engineering uses.† In order of their frequency of use, these methods are:

- Compaction and drainage.
- Additives: (a) soil, (b) cement, (c) bituminous materials and (d) chemicals.
- Electrical methods.

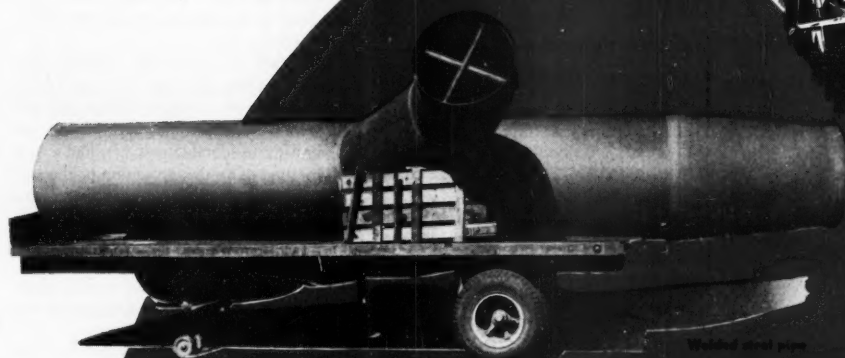
These methods are used to stabilize the surface and subsurface of roads, airfields, slopes, and earth dams; strengthen foundations for equipment and buildings; and seal water flow through pervious soil.

► **Mechanical Compaction Leads**—As brought out in the conference, the commonest way of stabilizing soil is

* Conference was sponsored by Massachusetts Institute of Technology. Collected papers and formal discussions will be published by M.I.T. in the near future.

† Don't confuse soil stabilization with soil conditioning. The latter term, recently associated with chemical additives like polyacrylates and male-vinyl copolymers, deals with agricultural, not engineering, uses of soil.

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Name	Properties	Characteristics
Pure Red Iron Oxides and Indian Reds	Fe_2O_3 -98.5% SpG.-5.15 Color—Salmon to purplish red	Composition: The basic colors of the iron and chromium oxides are determined by chemical composition. Reds are ferric oxide (Fe_2O_3); yellows, hydrated ferric oxide ($\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$); blacks, ferro-ferric oxide (Fe_3O_4); and greens, chromic oxide (Cr_2O_3). All these compounds are chemically stable and light permanent. Particle Shape: Physical properties such as oil absorption and suspension characteristics are dependent on particle shape, controlled by manufacturing processes. Size: Color range is controlled by particle size—average size increases as color darkens. Uniformity of size determines brightness. Purity: Freedom from impurities is essential for superior pigment properties and to prevent deleterious effects in end-products. Control of soluble salts, manganese and copper content are an important part of the Williams' manufacturing operation.
Pure Yellow Iron Oxides	$\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$ -99% SpG.-4.03 Color—Lemon to dark orange	
Pure Black Iron Oxides	Fe_3O_4 -96% min. SpG.-4.96 Color—Blue Black	
Pure Chromium Oxides (and Hydrates)	Cr_2O_3 -99% SpG.-5.20 Color—Light to dark green	
Natural Oxides—Ochers, Umbers, Siennas, Metallic Browns, Red Oxides	Wide range of ferric oxide content and red, yellow and brown colors	
Venetian Reds	Fe_2O_3 -40% SpG.-3.45 Color—Light to medium red	
Cuprous Oxide	Cu_2O -97% min.	
Extenders—Barytes, Calcium Carbonate, Calcium Sulfate, Silica	Wide range	

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News, cont. . .

by compaction, especially by mechanical means at an optimum moisture content. New heavy-duty rollers produce marked effects to depths of several feet.

Other ways include lowering the water table, so that the soil sinks under its own weight; surcharging the area with a sand layer; injecting silt under considerable pressure; and a new method of applying vacuum to the surface through a plastic or rubber membrane so that atmospheric pressure does the trick.

Compaction and drainage, however, do not always produce the desired results; you may have to find something to add to improve soil properties. The most common additive is another type of soil. Clay is added to sands; sand is added to clays; and so forth. The added soil is mixed with the original dirt to give a product that responds to compaction in the desired way.

Additives other than soil are the next choice. Many hundreds of materials have been tested in the laboratory; only two have been extensively used—cement and bituminous materials.† Both have some limitations, but with many soils they give excellent results; millions of square yards of subgrade for highways and airports have been stabilized with these materials.

Many chemical engineers and manufacturers are not aware that since about 1940 soil stabilization with cement and asphalt has become widespread; that the stabilized soil has good properties; and that it is cheap. Bituminous stabilization, for example, costs 10 to 15¢ per sq. yd. per in. of thickness; soil cement costs little more. It is with cost levels such as these that new chemical additives must compete.

Virtually the only commercial use of chemical stabilization at present is in grouting or injection of pervious soils.

The Joosten process, which involves successive injections of sodium silicate and calcium chloride solutions, has been used here since 1939 on some fairly large jobs.

New grouting materials, such as Shell-Perm (a special asphalt emulsion) and others, are being developed. These chemical grouts, by and large, are used for special work in sandy soil too fine for grouting by cement.

† Lime has been used somewhat to reduce the plasticity of soils, and calcium chloride has been tested extensively.

► **Stabilization by Electricity** — A method of temporarily stabilizing fine soils is by electricity, based on the principle of electro-osmosis in colloidal clay. This produces unusual effects; there is some permanent modification of soil properties caused by ion exchange and electrolysis. It has found only limited application, mostly in Europe.

Difficulties with ordinary methods arise principally with heavy silts and clays, which are too fine for injection, too tough for easy mixing, and often too soft for compaction. In civilian practice it is usually economical to remove them entirely and to import more tractable material.

► **Research by the Military**—Stabilization or solidification of these troublesome soils is the aim of recent research for the Armed Forces.

Several promising chemical additives and methods of using them have been developed. The aniline-furfural process is under study by the Navy; the Army Corps of Engineers is testing calcium acrylate, developed by M.I.T., and Chrome-Lignin (sulphite waste plus bichromate), developed by Cornell; the Marine Corps is using Plasmofalt, a binder of molasses plus asphalt or bunker fuel oil. The Army Engineers and the Marines are investigating soil briquetting as a means of forming "synthetic gravel" for temporary fill on unstable soil.

Mixtures of aniline and furfural, with polyfunctional amines and other additives to increase the chain length of the polymer, are reacted after mixing with sands to give a hard, water-proof surface layer. Calcium acrylate, after redox polymerization in place in the soil, imparts to silts and clays considerable tensile strength and rubbery qualities when the soil is wet.

Sulphite waste and sodium bichromate react in soils to give increased strength and impermeability to sands, silts and clays. Plasmofalt is used with sands; unlike other additives, it requires heat to bring about the reaction. All of these stabilizers are effective when used to the extent of 5 to 15 percent of the soil weight.

► **Trace Amounts Won't Do**—Requirements for a chemical stabilizer were discussed in detail, as were the possibilities of altering soil properties with trace amounts of chemical additives. Some chemical additives lock the effects of compaction of the soil; others give the soil new properties, such as tensile strength.

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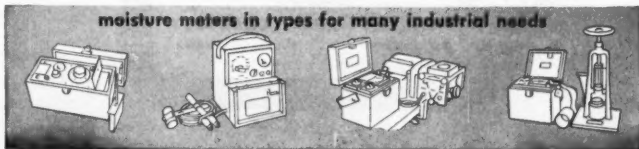
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News, cont. . .

It was concluded that for major changes in load-bearing properties, appreciable quantities of additive (to 10 percent of the soil weight, or more) are necessary. In addition, with fine-grained soils the additive must be compatible with water for incorporation with the soil, it must react in place to form a water-insoluble binder, it must possess strength of itself, and it must react and form bonds with the surface of the soil particles.

In most stabilization with additives, a phase change occurs after the stabilizer is in the dirt. Soil cement hydrates from the water in the soil. Asphalt stabilization depends on a change from liquid to semi-solid, by cooling, by loss of volatiles from cut-back asphalt, or from breaking emulsions. In chemical stabilization the phase change occurs through polymerization, oxidation or precipitation, alone or in combination.

Marked effects on some soil properties are caused by small amounts of chemicals, as with soil conditioners. Ion exchange of clays greatly changes their permeability and compressibility, probably through aggregation of the clay particles. Soil conditioners function in much the same way.

Other chemicals, such as sodium tetraphosphate, have the opposite effect—0.1 percent or less disperses the clay particles and greatly decreases the permeability. When high stresses from heavy loads are applied to these soils, however, the weak aggregates are broken and the soil behaves much as it did before treatment.

On the other hand, some of the changes are permanent and at least indirectly may affect the engineering properties of the soil. By causing soil to drain more easily or dry more quickly, or to keep water from flowing through it into undesirable places, great changes in the load-bearing capacity of the soil can result.

► **The Problem: Field Mixing**—Again and again during the conference it was pointed out that the chief problem is not to find additives that markedly affect soil properties. Many such additives are known, especially in view of the short time chemical stabilization has received serious attention.

The problem is to get the additives into the soil on a field scale. Mixing of cement and asphalt with fairly dry, sandy soil for highway and airport subgrades is done very satisfac-

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CRYSTAL UREA

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Washable summer suits once had to be starched stiff as a board to stay pressed. Then one starch maker found he could produce a far better laundry finishing agent by chemically combining starch with Du Pont Crystal Urea. This new product, called starch carbamate, gives an elegant drape and finish to washable suits, doesn't impact . . . and doesn't close the air space between the fibers, but lets the garment "breathe" and remain cool. New starch carbamate is also finding applications in other fields as an ingredient in water-base wall paints . . . and as a binder for glass fibers in the molding operation.

This is an example of the many product and process improvements made possible by the versatility of Du Pont Crystal Urea. Because of its high chemical reactivity, it's used in the synthesis of dyes and pharmaceuticals. In addition, it is used in the treatment of green lumber to promote even drying, and as a softener for paper and cellulose.



Du Pont Crystal Urea is important, too, in cosmetics, explosives, dentifrices, plastics and adhesives.

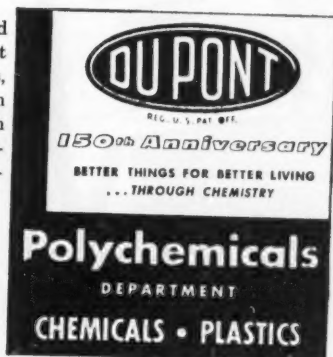
You, too, may find opportunities for profitable uses in Du Pont Crystal Urea or in many of the other Du Pont Polychemicals products for industry. There are more than a hundred of them—plastics, organic acids, amides, esters, resins and solvents.

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Technical bulletins on Crystal Urea and the chemicals and plastics used in your industry are available. Each product bulletin in the booklet presents physical and chemical properties, description, specifications, uses and possible applications, bibliography and other data. Write us on your business letterhead for your copy. We will gladly cooperate with you on any application for chemicals or plastics you would like to investigate. E. I. du Pont de Nemours & Co., (Inc.), Polychemicals Department, Nemours Bldg., Wilmington 98, Delaware.

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Better grass silage—cheaper

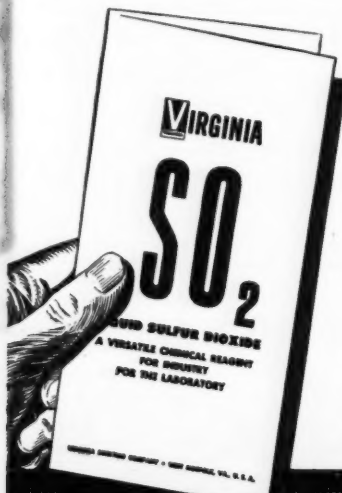
Untreated grass silage is, of course, highly perishable; and though various methods of checking fermentation have been employed, each has had its own drawback—difficulty of application, ineffectiveness, high cost.

Use of liquid sulfur dioxide, begun experimentally in 1940 and established commercially in 1951 by Virginia Smelting Company, has proved a most satisfactory all-round solution to the problem. Under the trade name "Silagas," the company's SO_2 is now in use on hundreds of farms. It has been found to be 30% to 60% lower in cost than any method previously employed—and successful in preserving a high proportion of proteins, organic nutrients and carotene that were lost in earlier ensiling processes.

Could SO_2 help you?

For three decades "Virginia" has been continuously working to make its SO_2 more useful to industry. To date, the versatile chemical has found a place in the operations of more than 40 different industries, as a reducing, neutralizing and bleaching agent, preservative and antichlor, and for pH control. Perhaps "Virginia" chemists could point out ways in which SO_2 would be helpful to you. They'd be glad to look into the possibilities, and without obligation. As a first step, why not send for our folder on "Virginia" SO_2 .

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News, cont. . .

torily by many types of stabilizing machines; some of these can process up to 350 tons of soil per hr. per unit.

But adequate mixing of additives with heavy clays, especially when wet and sticky, is beyond the abilities of existing machines. As a result, samples from field tests with heavy soils have strengths only 10 to 70 percent of those obtainable in the laboratory. Pressure injection can be used with some soils, but not with fine silts and clays; in general, injection is not satisfactory when the soil contains highly permeable material, such as gravel, and impervious pockets or strata.

For civilian use the economics do not favor chemical stabilization, except for special conditions or where trace quantities can be used. To date the development of major changes in soil strength has required considerable quantities of additive, which rules out chemical stabilization for nearly all civilian construction.

For military uses they show promise, but so far none of them has been proven in the field. Cheap additives, or additives effective in minute quantities, plus economical ways of incorporating them with the troublesome soils—these seem to be the keys to future widespread use of chemicals for soil stabilization.

Polyvinyl Alcohol Coming From New Cleveland Plant

The new plant of Colton Chemical Co. in Cleveland, Ohio, is now producing polyvinyl alcohol. Colton offers both a medium gray fully hydrolyzed grade and a high-viscosity fully hydrolyzed alcohol.

In addition, Colton produces polyvinyl acetate emulsions, polyvinyl acetate dry beads and phenol-formaldehyde solutions.

Uranium Processing Methods To Be Studied in Nevada

Methods of processing uranium ores and concentrates will be investigated at the University of Nevada. AEC has contracted with the university for developmental studies at a cost of \$60,000.

Beneficiation of low-grade uranium ores and extractive metallurgy for the

recovery of uranium and other metals from ores and concentrates will be explored. In beneficiation, ores are concentrated by purely physical methods.

The investigations will be conducted on a laboratory and unit process scale. No new facilities will be required at the university in Reno.



Man From Mars?

Earl R. Wallace may look like one, but actually he's a safety engineer for Eastman Kodak Co. Wallace, with fire extinguisher, has donned protective clothing, portable oxygen tank and phone-equipped oxygen mask for demonstration during recent safety program at Kodak Park plant of Eastman in Rochester.

Monsanto Steps Up Output Of Dicalcium Phosphate

Dicalcium phosphate will be produced in volume at the new plant of Monsanto Chemical Co. now under construction at Trenton, Mich. It is expected to be in operation this September.

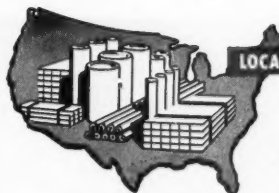
Dicalcium phosphate is becoming increasingly important as a phosphorus and calcium supplement in animal feeds. Monsanto will ship it in 100-lb. bags and in carloads.

The product will be made from 99.9 percent pure elemental phosphorus, of which Monsanto is the world's largest producer. A seventh electric furnace to turn out phosphorus will be completed this fall at Monsanto's Soda Springs, Idaho, plant.

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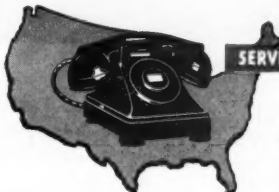
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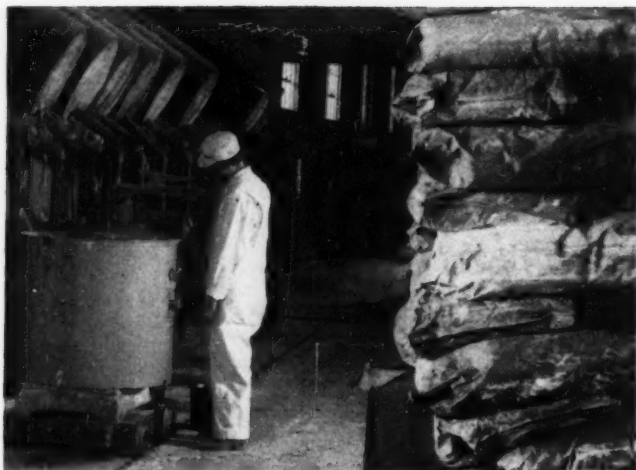
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MIX cans on overhead rail tilt and feed continuously into roller mills.

Scrap Gravity Flow, Up Output

That's what one Los Angeles paint firm has done. Single-level lines pan out better than multi-story gravity flow. Machine-hour productivity is up 60 percent.

It has always been something of a tradition for paint plants to be built on three or more levels. This, the reasoning went, was the smart way to take advantage of the gravity flow of materials.

But this tradition has now been

broken. Latest firm to break away is Sillers Paint & Varnish Co. in Los Angeles, producer of packaged paints.

In designing its new \$400,000 unit, Sillers abandoned the idea of the traditional multi-story, gravity-fed production line. Instead, it built its fac-

tory around the idea of a streamlined, single-level production line* housed in a single building. It also put into practice its "change-can" technique of moving paint mixes from storage to mixing to milling and finally to packaging.

Here're the benefits the Sillers people say they're getting from their single-story streamlined materials handling system now in use since early March:

- Construction costs were cut almost 50 percent.

- With only a doubling of floor space, output has been hiked over four-fold.

- With pretty much the same equipment, machine-hour productivity has been stepped up 60 percent.

All of which pleases President John V. Vaughn, idea man behind Sillers' break with tradition.

► **Change-Can System**—Sillers' plant is designed around a horizontal production line where batches are moved or stored throughout the system in "change-cans" of 125-gal. capacity. This technique, Sillers production men say, frees individual pieces of milling and mixing equipment from what was in the past unavoidable lost or idle time.

Both dry and liquid raw materials go directly from storage into 125-gal. change-cans (see cut) which move on trackage and by an overhead monorail system. The individual batch is then delivered to one of two Baker-Perkins mixers located in the storage area for pre-mixing.

Pre-mixing reduces the cubic volume of dry ingredients by a factor of about four to one. Thus the shrinkage in volume takes place in the storage area, whereas in the conventional gravity-fed system bulky dry materials must be hauled to the upper floor before this shrinkage takes place, the Sillers production people point out.

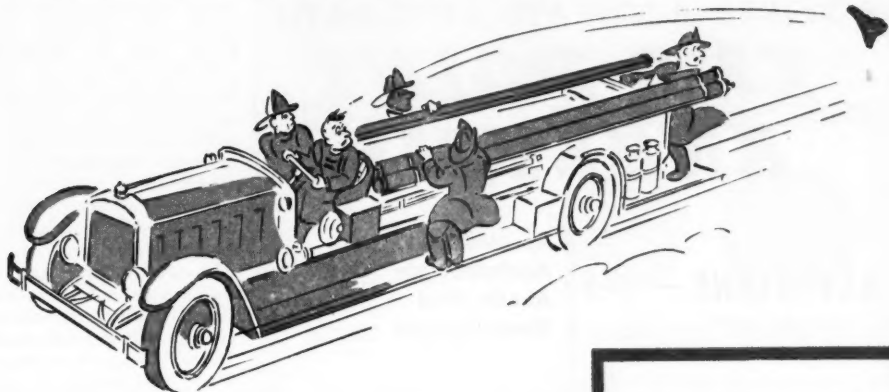
Compared with their own previous experience, Sillers finds that this slashes by about 48 percent the net movement of bulk per unit of product turned out.

Each mixer has special ventilation facilities to draw off 1,100 cu. ft. of air per min. during operation. As soon as a change-can mixture is complete, the mixer is free for the next load. Meantime, the can of pre-mixed material enters the factory area.

The mills are served directly from the cans, which are hoisted sufficiently to flow and are mechanically tilted. In processes requiring re-milling, the

*One of the first big plants to go to the single-story design was the Torrance, Calif., unit of Pittsburgh Plate Glass Co. It went into operations early last year.

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De Laval Centrifugal Separators and Clarifiers speed up industrial processes by making them *continuous*. When they replace gravity or other less efficient methods of separating two liquids or removing solids from one or two liquids, these De Laval machines quickly relieve the "bottleneck" of a process.

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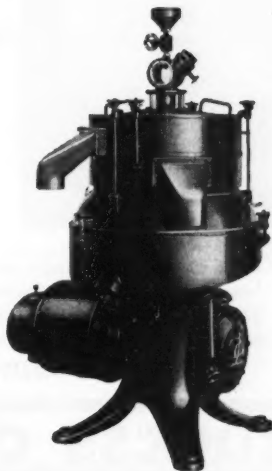
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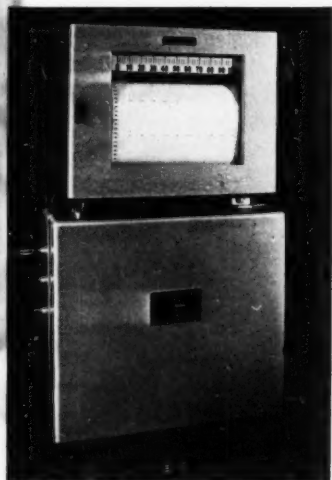
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News, cont. . .

feeding can and receiving can are simply interchanged and the process continues through another cycle.

▶ **The Mill's the Heart**—Heart of paint making is the mill, which may be either the open or closed type. In the open type, raw materials (dry ingredients and liquid vehicle) are first fed to a mixer, then to the mill in a continuous flow. Two mixers feed one open mill. One feeds the mill while the other is being loaded for the next batch.

In closed mill operation, unmixed raw materials are fed directly into the mill, but each operation begins with a mixing cycle before the materials are "wetted" enough to undergo milling. Some 10-30 percent of closed mill time is usually lost in non-productive mixing.

Where production calls for a relatively large number of small mixes (as in making shelf-goods paints) the old-type mixers often prove a production bottleneck; they must be shut down for a clean-up each time a line shifts from one color or type of paint to another.

Sillers' design eliminates the materials rehandling, and saves a substantial part of stand-by, clean-up and other non-productive time on equipment. For example: change-over time on an open mill is now about five minutes; it used to take as long as an hour.

Milled mixes are pumped from the point of discharge into a battery of storage tanks, elevated eight feet above the floor, to feed the two lines of automatic filling and capping machines.

Where tinting is required, mixes are taken again in the movable cans to a battery of six tinting mixers before entering the filling-machine storage tanks.

Celanese Making Trioxane In New Unit at Bishop

Celanese Corp. of America has started volume production of trioxane, new and superior solid fuel for heating field rations for the armed forces in Korea and elsewhere. The production unit at the Bishop, Tex. plant is the first of its kind in the world.

Chemical raw material for trioxane is paraformaldehyde. To produce the new fuel on a large scale, Celanese had to expand its capacity for para-

formaldehyde. "As a result," says Richard W. Kixmiller, general manager of chemical operations, "the company will have the largest capacity for solid formaldehyde of any company in the world."

Production of trioxane by Celanese is a direct outgrowth of a process developed by the Celanese research laboratories at Clarkwood, Tex., for low-priced paraformaldehyde in flake form.

The company's capacity will be in excess of current military requirements; this added capacity can be brought quickly into production if needed. Meantime, commercial quantities of trioxane will be available for development work in the civilian field.

Ethyl Moves Into Output Of Lindane From BHC

A plant for volume production of lindane is now being constructed by Ethyl Corp. at Baton Rouge, La. The new unit is expected to be operating by the first quarter of next year.

Simultaneously, Ethyl is nearing completion on greatly expanded facilities for production of benzene hexachloride, from which lindane is derived.

Ethyl's entry into lindane manufacture springs from its experience in producing chlorinated compounds and from research and development in agricultural chemicals. In addition to antiknock compounds, sodium and chlorine, Ethyl makes ethyl chloride, ethylene dichloride and related chemicals.

AFL Chemical Workers Sign Pact With Columbia-Southern

American Federation of Labor International Chemical Workers at Columbia-Southern Chemical Corp.'s Natrion, W. Va., plant have signed a three-year contract with the company. It provides for 9 c. an hr. cost-of-living increase, plus 4 c. annual improvement beginning with June 1952 for the life of the contract.


About 350 hourly employees at the firm's West Virginia plant are covered by the agreement.

Plant superintendent Earl Wolf and Harry Gamble, president of Local 45 of the International Chemical Workers announced that the contract continues the same flat no-strike clause contained in previous agreements.


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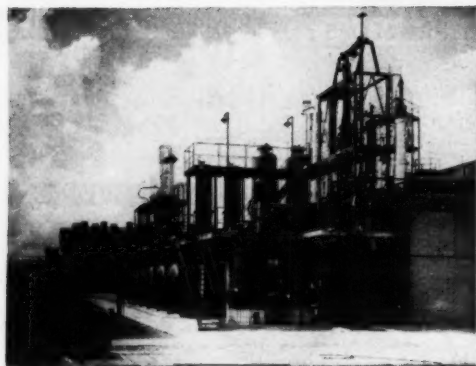
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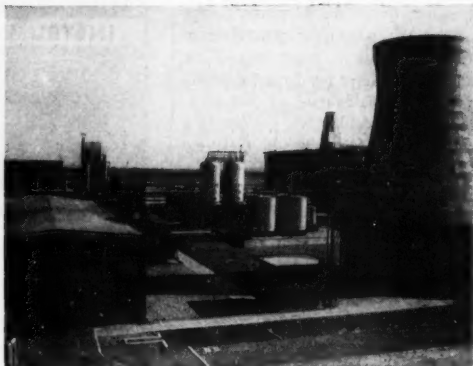
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Distilling unit of plastics plant.



General plant view with cooling tower in right foreground.

Switch in Vinyl-Chloride Making

With a high-yield process, Dutch vinyl chloride plant utilizes ready source of dichloroethane as starting material. Most U. S. plants use C_2H_2 and hydrogen chloride.

Almost theoretical conversion of pure dichloroethane into vinyl chloride (2,000 tons a year) and hydrogen chloride—that's what Royal Dutch Shell is accomplishing at its Pernis, Holland, plant. Their continuous process avoids any further splitting of the vinyl chloride and minimizes formation of high molecular or tarry materials.

Raw material—dichloroethane made from coke oven ethylene and chlorine—comes from the company's Royal Netherlands Blast Furnaces and Steel Factories at Ymuiden.

Pernis process is essentially a thermal decomposition. It is carried on at temperatures higher than 300 to 400 deg. C. in the presence of contact agents such as pumice, china clay, activated carbon, titania. Process pressures vary from 14 to 71 psi.

The reactor is made up of a number of tubes fitted into a vertical furnace. Heat must be introduced through the walls of the tubes which are filled with a contact mass.

Vaporized dichloroethane coming in at the top contains a minimum of water to avoid corrosion troubles. Reaction products are withdrawn at the bottom.

To avoid decomposition, the tubes cannot be allowed to become too hot. So a special gas burner protects them against direct contact with the flames. A valve system directs combustion

gases upward around the tubes, permitting exact control.

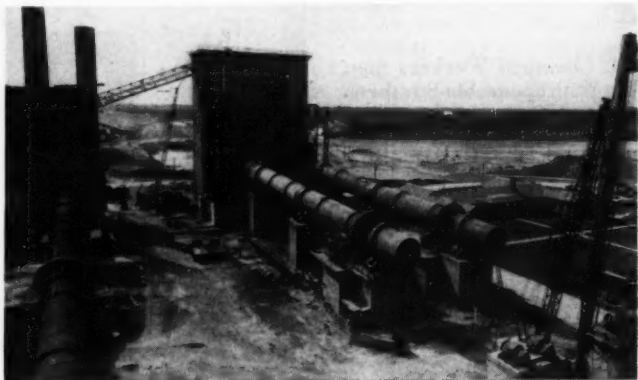
Reaction gases leaving the tubes are cooled rapidly. This brings the reaction to a stop and condenses high-boiling-tarry constituents which are withdrawn from the cycle.

The hydrogen chloride byproduct is removed by absorption in a column of refrigerated dichloroethane. The column has a temperature of 2 to 10 deg. C. at the top, and a tempera-

ture of 40 to 50 deg. at the bottom.

Hydrogen chloride leaving the column contains traces of vinyl chloride and dichloroethane. Product collecting in the lower part of the column contains vinyl chloride, unconverted dichloroethane and traces of material with higher boiling points. This mixture is passed to another column. Vinyl chloride is withdrawn from the top and condensed by water cooling. Part of the remaining dichloroethane goes to the column for the absorption of hydrogen chloride, part is distilled and returned to the process.

Byproduct hydrochloric acid is freed from traces of dichloroethane and vinyl chloride by washing with water in countercurrent in a closed column filled with Raschig rings.



Big Kilns Mean More Dolomite

Two new rotary kilns, the largest in the refractory industry, are being erected at the Maple Grove, Ohio, plant of Basic Refractories Inc. The

kilns are 390 ft. long and 11 ft. in diameter. They're part of the company's \$3.5 million expansion at Maple Grove. (Continued)

• Davison Bulletin •

Davison Produces Raney Nickel Catalyst

Production of Raney nickel catalyst, widely used in industrial hydrogenation operation, has been started by The Davison Chemical Corporation in its Specialty Catalyst Plant.

The product is essentially a spongy form of nickel, produced by leaching aluminum from an alloy of approximately 50 per cent aluminum and 50 per cent nickel. The resultant catalyst has a maximum particle size of 140 mesh and a very high surface area. When used in hydrogenation Raney nickel catalyst can be filtered out and reused as many as 250 times or more.

For information and a complete Product Data Sheet on Raney nickel catalyst, mail the coupon or contact your Davison Field Service Engineer.



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Investigate Davison Silicofluorides

Davison's Potassium Silicofluoride (K_2SiF_6), Sodium Silicofluoride (Na_2SiF_6), Zinc Silicofluoride ($ZnSiF_6 \cdot H_2O$), Magnesium Silicofluoride ($MgSiF_6 \cdot H_2O$), and Ammonium Silicofluoride ($(NH_4)_2SiF_6$) can be all important to you as chemical intermediates. Their acidic properties and fluoride content can help you in your manufacturing processes, enabling you to produce a better or more economical product.

Davison's Silicofluorides have found wide applications, such as: a gelation agent in the production of foam rubber; the production of zirconium fluoride; electroplating; a low cost flux and opacifying agent in titanium frits; catalysts for plastic materials; insecticides; water fluoridation, etc.

Many new and varied applications are being discovered through Davison's Research and Development program. Davison Silicofluorides, development facilities and research personnel are at all times available to help you with your particular problem. For samples, prices, and further information, contact your Davison Field Service Engineer or mail the coupon.

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News, cont. . .

When in operation, these kilns will "dead-burn" about 2,000 tons of dolomite daily and will expand Basic's annual production of granular dolomitic refractories by about 50 percent. This added capacity is needed to meet growing demand of the steel industry for refractories.

At Maple Grove, Basic quarries almost chemically pure dolomite containing over 99 percent of the double carbonate of calcium and magnesium. A mill at the quarry site crushes, washes and screens the quarried ore. Sizes of stone vary from 4½ in. to very fine. The ¾-in. stone is fed by belt to the silo, which in turn mechanically portions the dolomite and other raw material to the kilns.

The kilns lie on an incline—18 ft. higher at the feed end. In operation, kilns turn slowly at about ½ to 1½ revolutions per minute. The incline and rotary motion keep the dolomite mixture moving. Powdered coal is fired into the kiln from the discharge end. As the mixture moves toward discharge, it is progressively heated, until near discharge, it reaches higher than 3,000 deg. F. This constitutes "dead-burning." After the heating, the mixture is cooled and conveyed to shipping platforms.

Dead-burning changes the dolomite mixture physically and chemically, improving its refractory characteristics. The refractory product is used in the construction and maintenance of basic open-hearth furnaces.

Within the last 35 years, granular dead-burned dolomite has come to be the most important dolomitic refractory made in this country from the standpoint of both tonnage and value.

In addition to its production of dolomite at Maple Grove, Basic Refractories produces equally important magnesitic refractories at its Gabbs, Nev., plant, recently expanded by purchase of Sierra Magnesite Co.

Thermofor Cat Reformer To Make High-Octane Gas

A multi-million dollar thermofor catalytic reforming unit being constructed at the Beaumont, Tex., refinery of Magnolia Petroleum Co. will swell Magnolia's output of high-octane gasoline and petrochemicals when it goes on stream early in 1953.

Thermofor catalytic reforming, or TCR, has been successfully producing

high-grade gasoline in a Socony-Vacuum pilot plant 24 hr. a day for two years.

The new Beaumont TCR unit is only one of three that Socony will build, together with a new bead catalyst plant, at a total cost of \$27 million. Other TCR's will go up at Augusta, Kan., and Torrance, Calif. The bead catalyst unit will be erected at Paulsboro, N. J.

The new Beaumont unit will be capable of running 19,000 bbl. of charge stock a day.

Government approval of Magnolia's project, cleared by the Petroleum Administration for Defense, was based largely on the unit's capacity for turning out large volumes of aviation gasoline.

Magnolia engineers say the TCR unit will increase production of aviation gasoline by about 6,000 bbl. a day. The unit's products will also be used to hike octane numbers of motor fuels to meet engine demands. Higher compression engines might require octane numbers in the 98-100 range within a few years.

The TCR is Socony's way of anticipating the continuing rise in octane ratings, according to Magnolia officials. It will help supply fuel for the advanced piston-engined planes and powerful automobiles to come. It will likewise furnish petrochemicals.

The process is akin to the thermofor catalytic cracking (TCC) method used in four units at the Beaumont refinery of Magnolia. A specially designed bead catalyst, chromia-alumina gel, is used. It helps to break down the petroleum feedstock and effect the conversion to high-quality gasoline. The catalyst can be regenerated and used many times.

Flowing into the TCR unit, naphtha is first heated to about 900 deg. F., then sent into the reaction chamber. Catalyst, in a fluid bed, moves down through the reactor by gravity.

Heated and under pressure, with the catalyst aiding the reaction, the naphtha undergoes a molecular change. TCR units operate at pressures of only 100 to 200 psi.—50 to 80 percent lower than competing processes.

A series of conversion reactions, including isomerization, cyclization, dehydrogenation, desulphurization and hydrocracking, produce high-octane reformate rich in aromatics. The high-octane product, according to Mag-



KELVINATOR has standardized on **PLATECOIL**

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The Flexseal Melting Tank pictured above is one of many heating processes utilizing Platecoils at the Kelvinator Division, Nash-Kelvinator Corp., Detroit, Michigan. They have found that Platecoils have so many advantages for heat transfer operations that they have standardized on their use in such applications as alodizing tanks, defluxing dip tanks, defluxing washers, parts washers and dip alodizing systems.

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- ★ **STEAM LEAKS REDUCED.** Platecoils have no joints in the solution. Irritating steam leaks have been greatly reduced.
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NEWS, cont...

nolia officials, can meet zooming octane demands for years to come.

The TCR unit can also provide aromatics to increase the supply of petrochemicals. Benzene, toluene and xylenes could, for example, be recovered.

Industry Backs AIChE in Plate Efficiency Research

Plate efficiencies in fractionating towers will be investigated in a five-year research project in which the American Institute of Chemical Engineers and 25 chemical, petroleum and engineering organizations are co-operating.

Work is just getting started, according to the Research Committee of AIChE. Cooperating companies have furnished \$64,000 to pay for the first year's work. The research is being carried out at the University of Michigan, University of Delaware and the Polytechnic Institute of Brooklyn.

Fundamentals of tray efficiency, both in fractionation and absorption, will be explored. Initial work will cover the effect of system properties on tray efficiencies. Later, tray design and column hydraulics will be investigated.

The Research Committee of AIChE was organized by the Council of the Institute in July 1950, "to foster research projects in chemical engineering which by their scope, complexity, or general nature, were such that no single institution or company could afford to institute a comprehensive planned research program."

Supervising the initial project will be Brymer Williams at the University of Michigan, J. A. Gerster at the University of Delaware and Ju Chin Chu at the Polytechnic Institute of Brooklyn.

Companies backing the project include Columbia-Southern, Newport Industries, Allied's Barrett Division, Standard Oil Development, Standard of Indiana, Sharples, M. W. Kellogg, Gulf Research & Development, Hercules, Union Carbide, Sun Oil, Universal Oil Products, American Cyanamid, Socony-Vacuum Laboratories, Lummus, Tide Water Associated Oil, Fluor, Ohio Oil, Hydrocarbon Research, Dow Chemical, Monsanto, Arthur D. Little, Eastman Kodak, Pure

Oil, Vulcan Copper & Supply and Ethyl Corp.

Members of the Institute Research Committee are: W. E. Lobo, chairman, M. W. Kellogg; W. E. Catterall, Standard Oil Development; R. A. Kinckner, Du Pont; H. L. Malakoff, Cities Service Research & Development; G. T. Skaperdas, M. W. Kellogg; M. Benedict, MIT; H. E. O'Connell, Ethyl Corp.; and J. W. Mayers, Sharples Chemicals.

Kurth Process Extracts Chemicals From Fir Bark

M. W. Kellogg Co. will explore the possibilities of extracting commercially valuable chemicals from Douglas fir bark. The state of Oregon has granted Kellogg an option contract on a bark extraction process developed by Dr. E. F. Kurth, chemist in the forest products laboratory at Oregon State College.

Three chemicals can be recovered by the Kurth process: wax, dihydroquercetin and tannin. The National Bureau of Standards finds wax from Douglas fir bark to be high quality and potentially competitive in commercial markets. Tannin is mainly used for leather tanning and for controlling the fluidity of muds used in oil-well drilling.

Dihydroquercetin, a white crystalline organic compound, can be put to use in pharmaceuticals and in preserving foods. As an antioxidant, it can prevent rancidity in fats and oils such as lard and butter. It also aids in treating frostbite and fragility of blood capillaries.

This will be the first time that Oregon has licensed a state-owned patent. A similar deal will be offered to Canadian Forest Products, Ltd., of Vancouver, British Columbia, for Canadian rights.

The option agreement covers an eight-month period of investigation, and may be followed by an 18-month pilot-plant stage, and then an exclusive production contract for five years.

Kellogg made an initial payment of \$2,000 within 15 days after signing the contract. During the eight months of investigation, the company will make quality and market studies.

All factors being equal, Kellogg has agreed to use bark from Oregon's Douglas firs and to locate the commercial plants, if and when built, in Oregon.

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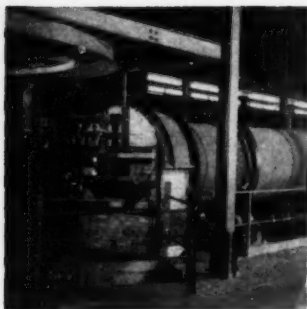
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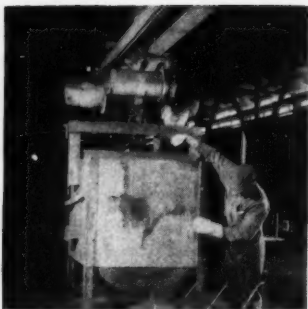
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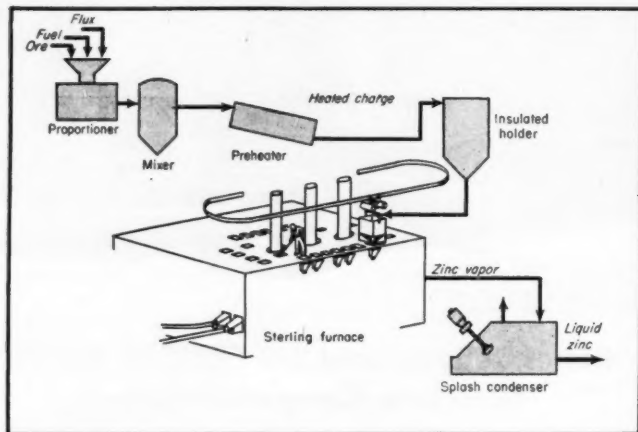
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Now — Arc Furnace Zinc

For the first time, temperature is controlled well enough for smelting zinc in an electric arc furnace. Zinc vapor quickly quenched, liquefied with novel condenser.

New Jersey Zinc at Palmerton, Pa., has a new zinc smelting process that's as far removed from conventional methods as the modern apartment's oil burner is from the old Franklin stove.

It's the first time an electric arc furnace has been used successfully for this job.

Here, from basic information developed by New Jersey Zinc's E. C. Handwerk, G. T. Mahler and L. D. Fetterolf, are the facts behind this new achievement in zinc metallurgy—the Sterling process, so called because it was first designed to process

ore from the company's Sterling Hill mine in New Jersey.

In the past, all commercial processes for smelting zinc have operated below the melting point of the gangue, so that the residue has had to be discharged as a solid. Electric arc furnace smelting allows the residue to be tapped off as molten slag—a continuous and much simpler operation.

Another technical bottleneck solved in the electric arc smelting of zinc is the formation of "blue powder," or zinc dust. In the past, zinc vapor condensed predominantly, not to

liquid zinc, but to blue powder which had to be melted down in a separate operation. In the Sterling process the zinc vapor condenses predominantly to liquid metal.

There are two ways, theoretically, to secure these advantages.

The first: Operate with the arc submerged in molten slag. Then heat is transferred to the solid charge (floating on the slag) through the slag itself. Reduction takes place mostly at the interface between slag and charge. By keeping a close watch on slag fluidity, zinc vapor can be formed without volatilizing appreciable lime, silica or other products which form nuclei on which zinc vapor can condense to blue powder. Drawback of this method is that the extreme heat applied to the mobile slag sets up the risk of damaging furnace walls.

Second method: Let open arcs play from the electrodes to the surface of the slag without impinging on the solid charge. Heat to the charge is mostly by radiation so that zinc is vaporized from the surface of the charge before it can get in the slag.

New Jersey Zinc uses a combination of both methods, with a preponderance of the second.

The two most important aspects of the process are (1) temperature control; and (2) quick, efficient condensing of zinc vapor. Here's how it's done.

► **Intense Temperatures Utilized**—Utilizing the intense heat—over 3,000 deg. C.—of the electric arc while keeping the bulk of the furnace below 1,450 deg. C. is a major achievement of the new process. This trick is made possible by letting the charge banks quickly absorb the radiated heat for the endothermic reaction. The highly fluid, agitated slag bath also

dissipates some of the heat from the arc, distributing it to the charge floating on the surface where it is consumed in the reduction reaction. High temperatures are confined to the center of the furnace, making it easier on the refractories.

► **Slag Fluidity Controlled**—This factor is favorably adjusted by adding lime or silica. The $\text{CaO}:\text{SiO}_2$ ratio is kept in the range 0.8:1 to 1.4:1. This keeps the mix fluid enough at 1,300 to 1,350 deg. C. for the reduced iron globules to settle through the slag and form a pool on the bottom. It permits easy tapping of the slag as well. But the most important reason for fluidity and mobility is to distribute heat from the arcs to the charge and the molten iron.

► **Shower Bath of Liquid Zinc**—The second important consideration is control of the condensation step. Key to this operation is the unique splash type condenser. This equipment has been described* essentially as follows:

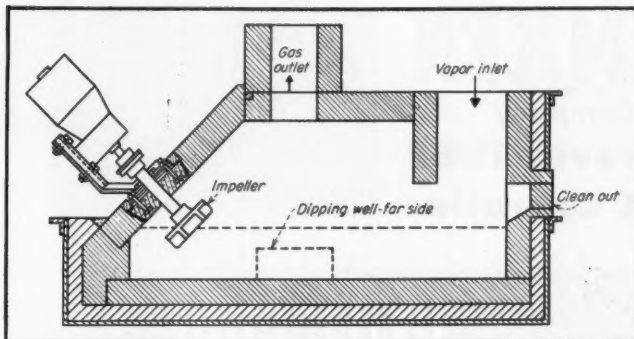
In splash-type condensers the gas-vapor stream passes through a shower of molten zinc kept at 500 deg. C. by water-cooled coils set in the liquid zinc bath. An impeller (see cut) creates a shower or curtain of molten zinc which sweeps every part of the channel above the bath. The mixture of zinc vapor and reduction gas passes continuously through this channel.

The walls of this chamber are insulated, rather than cooled, so that virtually all of the heat liberated in cooling the gas and condensing the zinc is absorbed by the drops of molten zinc.

Physical blue powder formation is virtually eliminated, and a very high percentage of the zinc input is recovered as molten metal.

The drops of zinc, augmented by the zinc that has condensed from the vapor, fall back into the bath of liquid zinc and are recooled. The extremely rapid cooling also tends to minimize the formation of chemical blue powder.

Remarkable compactness is attained by the enormous liquid zinc cooling surface generated in a small volume and the ability of the immersion coolers to remove this heat from a small sump. A unit having an internal gas volume of 28 cu. ft. will condense 10 tons per day.



CORE of the process: the splash type condenser scrubs zinc vapor with molten zinc.

Another important process consideration is to keep the gases passing from furnace to condenser low in CO_2 . The chemistry of the reaction easily explains the reason for this. When a mixture of ZnO and C is heated, ZnO is reduced to zinc vapor and CO. Carbon monoxide, the active reducing agent, is regenerated from CO_2 by reaction with carbon. These reactions are reversible; any CO_2 remaining in the reaction product will reoxidize zinc vapor during cooling.

The trick, then, is to maintain high temperatures which do not favor the reversion of CO to CO_2 and, therefore, do not permit reoxidation of zinc vapor.

After learning to control these and other key steps by experimenting with progressively larger electric furnaces, the company last year built a rectangular furnace with internal dimensions of 16 X 32 ft.

This furnace, at Palmerton, Pa., is made of high-grade firebrick with sidewalls 24 in. thick, a three-course, inverted arch bottom and an arched roof 15 in. thick. Bottom of the furnace is air-cooled; the sidewalls water-cooled. Three 24-in. diameter graphite electrodes are operated on a three-phase circuit. Power comes through a 6,000-kw. transformer.

Here, from ore to ingot, is how it works.

A mixture of zinc oxide, coke and flux are proportioned, blended. These are then fed into a rotary preheater, fired with the CO produced as a by-product of reduction. It takes about two hours for the mix to heat to 850-900 deg. C. In this step, some of the coal volatile goes off, some of the Fe_2O_3 is reduced to FeO, and CuO—

it present—goes down to Cu_2O or Cu.

► **Unique Charging Operation**—The heated mix, as it discharges from the preheater, is collected in insulated holding hoppers and from these it is withdrawn in lots of 2 to 3 tons each to charge the furnace.

Hot charge is carried to the furnace by monorail in an insulated car. Charge is fed directly into a series of hoppers located in the furnace roof along the inside perimeter of the four walls. The idea is to make the charge absorb the heat which otherwise would be carried to the furnace walls.

Recirculation and charging of by-product blue powder and dross are handled in the same general way.

A round of charge is fed to the furnace at one-hour intervals. Molten slag and iron collect in a pool on the hearth of the furnace. Depth of molten bath carried in the furnace is variable.

Usually enough iron is carried to maintain a protective layer and permit taps of 5-10 tons at a time; enough slag is maintained over the molten iron bath to avoid any direct contact of the arcs with molten iron.

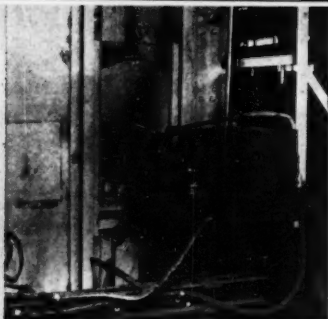
Zinc vapor and carbon monoxide, as well as lead, cadmium and some silver, pass out of the furnace, through refractory connectors, into the splash condensers.

Noncondensable gas (mostly CO) passes from the condensers into a scrubber where it is washed with fine water sprays to get rid of any solid materials. The gas then goes through a water venturi which controls, automatically, back pressure on the furnace.

► **Topflight Performance**—The Palmerton works has had its furnace going since July 1951. Runs of a month or

* Bunce, E. H. and Peirce, W. M., *Eng. and Min. J.*, March 1949, pp. 56-62.

The
TIMKEN
Company
Improves TUBE
MILL Operation



"Utiliscope" Camera looks directly into furnace at charging end.

With the
DIAMOND "UTILISCOPE"
(WIRED TELEVISION)

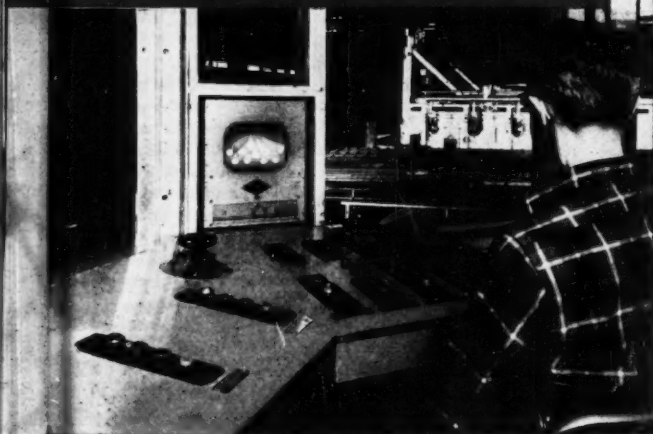


Image of furnace interior on "Utiliscope" viewing screen, right in front of dispatcher 80 feet away.

In a seamless tube mill of The Timken Roller Bearing Company, both the mill and the heating furnace are controlled by a single dispatcher. Tubes are automatically fed into the furnace sidewise . . . travel through on a conveyor. To watch both the mill and the furnace, the dispatcher must be about 80 feet from the furnace charging end.

Formerly a second man was required at the charging end to avoid tube "pile ups" in the furnace. Now a Diamond "Utiliscope" (Wired Television) Camera looks directly into the furnace . . . the image is brought to a viewing screen right in front of the dispatcher. It's easy for him to maintain even furnace feed and avoid "pile ups."

This is one of many examples of improved operation with a saving in cost that has been made by using the "Utiliscope". For further information, write for Bulletin 1025-C.

OTHER USES include studying destructive tests of engines, checking remote gauge readings, viewing nuclear research, etc.

The "Utiliscope" Reg. U. S. Pat. Office.

4826



DIAMOND POWER SPECIALTY CORP.

FIRST IN INDUSTRIAL TELEVISION

LANCASTER, OHIO • OFFICES IN 39 PRINCIPAL CITIES

Diamond Specialty Limited — Windsor, Ontario

Since 1903, Diamond has Manufactured

Quality Equipment For Industry

News, cont. . .

more each have been made on several ores and typical high-grade zinc concentrates. Highest sustained power input has been 4,500 kw., but this is not the limit of furnace capacity.

Capacity demonstrated is better than 35 tons per day on a 50 percent or higher zinc concentrate carrying up to 15 percent iron. Such a concentrate will yield 95 percent of its zinc.

Over-all power consumption is less than 3,000 kwh. per net ton of slab zinc turned out; auxiliary power, 150 kwh. per ton. Power factor is 95 percent or better. Operating time (power on the electrodes) has been kept up to 90-95 percent.

Electrode consumption has been 13-15 lb. per ton of zinc metal. There hasn't been enough operating experience to give figures on refractory life except to say it's economically O.K.

It all adds up to the one thing that the people in the front office wait to hear: "Process ready for commercial application."

Record Tung Crop: The 1952 tung crop is expected to break all records. It's already estimated that it will be 15 to 20 percent higher than 1949's 87,900-ton crop. More than 65 percent of the tung nuts grown in the U. S. are produced in Louisiana and Mississippi. These two states have six of the nation's tung oil plants, including the largest in the U. S. at Picayune, Miss., handling 200 tons of nuts daily.

Profitable Palette: Monsanto, together with color consultant Faber Birren, has come up with a palette of 18 colors popular in houseware goods. The colors are divided into three groups—mass market, current trends and high style. They're based on the premise that the most beautiful colors are the ones that sell, and were selected after surveys of houseware sales and sales of other household furnishings, plus consumer polls and sales tests. "Our aim," says George W. Ingle of Monsanto's color service, "is to put into plastic products those colors which have the best chance to increase sales to the public. By promoting a minimum of selected colors from the 20,000 hues Monsanto has matched in plastics, we also aim to reduce inventory risks."

—MEMO—

to top management:
This advertisement
might profitably
be called to the
attention of your
technical director.

...if

Oxidation Is One Step In Your Process

Investigate low cost dependable

WELSBACH
ZONE

if

... your present process requires an oxidant, the potentialities of Welsbach Ozone in increasing your profits through lowering costs make it wise for you to check its possibilities... now!

On the basis of cost, of convenience, of rate of reaction, of yield or of freedom from extraneous substances, Welsbach Ozone is the outstanding chemical oxidant.

It will pay you to look into the use of Welsbach Ozone—not on the basis of cost alone but with consideration of these extra advantages too:

WELSBACH
ZONE is

- Economical...
 - Efficient...
 - Dependable...
- an outstanding oxidant!

No storage problem; no procurement problem; no materials handling.

Fully automatic. No complicated control problems.

Generated at point of use with equipment requiring little space.

No full-time supervision or labor required.

Constant, predictable operating cost.

Write for information.

THE WELSBACH CORPORATION

ZONE PROCESSES DIVISION

1500 WALNUT STREET, PHILADELPHIA 2, PA.

Pioneers in Continuing Ozone Research

Readers' Views & Comments

Latest Theory on Grinding

Sir:

I was interested in the news story you ran recently (April, p.242) on the Third Theory of Comminution as formulated by Fred Bond of Allis-Chalmers.

I'm wondering why you didn't publish more on it. The full paper, it seems to me, would have been of great interest and practical value to many chemical engineers . . . for Mr. Bond's theory is certainly stimulating to all of us who have worked in the field of crushing and grinding. . . .

JOHN M. O'HARA

Engineering Consultant
Los Angeles, Calif.

► Mr. Bond's original paper, delivered before the AIME, was of prime interest to mining engineers. For this reason, we made only a short abstract of it.

But (like Reader O'Hara) we saw its value to chemical engineers, immediately asked Mr. Bond if he would prepare an article especially for our readers.

He agreed. So within a few months you'll see the article in which Fred Bond explains his new theory of crushing and grinding and how it can be of practical value to you.—Ed.

More for Design Engineers

Sir:

In a recent questionnaire you asked me to do you a favor and tell what I like and what I don't like about *Chemical Engineering*. . . .

But one of the things I don't like is that you don't publish (to my way of thinking, at least) enough articles for the design engineer . . . I mean design in practice, not theory.

ALVIN C. WHITE

Chemical Engineer
Philadelphia, Pa.

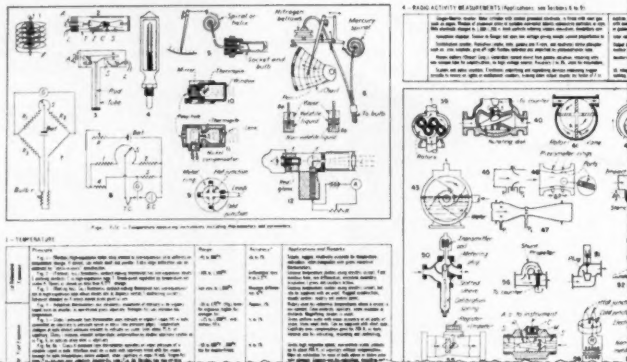
► Design engineers, we admit, make up a good portion of our readers. Yet we have just as many—maybe more—that're in development, production, supervision, maintenance or what not. So we must try to keep, as editors say, a "balanced" magazine.

But we'll soon have several articles aimed right at the design engineer. One will be on design calculations for cooling coils.

And next month we'll have more on heat exchanger design. Also a feature report on adsorption that'll certainly interest design engineers. Then a little later we plan to have a first-class article on the design features of high-temperature equipment.—Ed.

CHEMICAL ENGINEERING GUIDE TO PROCESS INSTRUMENT ELEMENTS

First Edition, December 1952 Copyright 1952, McGraw-Hill Publishing Co., Inc.



Instruments: What You're Saying

It's been a long time since anything we've published has pulled so many comments as our May report on Process Instrumentation. Here's a sample of what they're like.

Guide to Elements

Sir:

Your 64-page report on Process Instrumentation is superb. It is an outstanding contribution to the profession and you and your assistants deserve a resounding vote of thanks for the thorough and unbiased manner in which you attacked this highly complex subject.

The Guide to Process Instrument Elements will fill a gap in the instrumentation literature which has always existed. The task was a tremendous one and I can appreciate the many long hours you must have devoted to the organization and arrangement of these important data—especially when factors concerning accuracy are covered.

DOUGLAS M. CONSIDINE

Editor-in-Chief

(Forthcoming) Instrumentation and Control Handbook, Philadelphia, Pa.

► This Guide (a 16-page, 30 x 45-in. folded chart) was the brainchild and work

of Senior Associate Editor T. R. Olive. To our knowledge, it's the first time anything like it has been tackled.

Ted worked on this one chart almost exclusively for over a month—and I mean 18 hours a day, 7 days a week, too. Working material alone tipped the scale at 74 lb. Ted's brief case was literally a suitcase jammed with bulletins, letters, books and other source literature.

The chart has 210 drawings and contains data on the elements of 550 different instruments. Some 67 companies collaborated; the products of well over 100 firms are included.

So far we've heard of only one firm that was inadvertently omitted.—Ed.

As a Teaching Aid

Sir:

I was very much pleased to see the feature report on Process Instrumentation in your May issue.

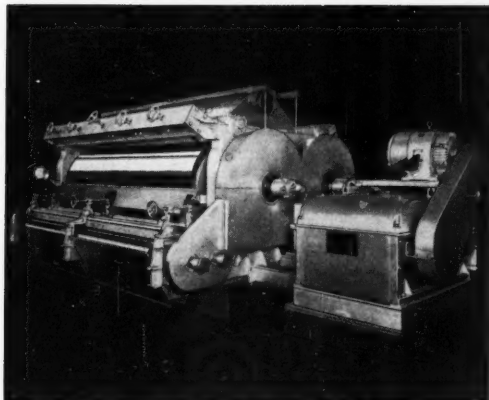
As a teacher responsible for a graduate course in process control instrumentation, I want to say that your chart entitled Guide to Process Instrument Elements is going to be very helpful to students taking such a course. I sincerely hope that reprints

A Headline that is also a Helpline!

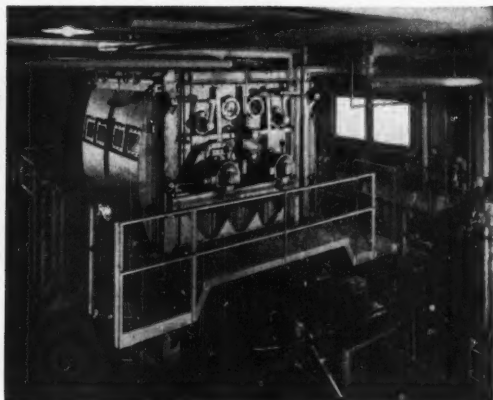
- 1 BUFLOVAK
DRUM DRYERS**
- 2 CONTINUOUS DRYING
FOR LIQUID MATERIALS**
- 3 LARGE CAPACITY
... LOW COST**
- 4 SAFE DRYING**
- 5 GIVE THE RESULTS
YOU WANT**

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Catalog No. 348 has complete information. May we send you a copy?



Soap is dried on this special BUFLOVAK Atmospheric Double Drum Dryer equipped with cooling rolls.



BUFLOVAK Vacuum Double Drum Dryer, sanitary type, Stainless Steel, with chrome plated drums. Used for drying a food product.

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By-Product Recovery
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Dryers

Vacuum Double Drum

Vacuum Rotary

Pilot Plant
Atmospheric

Processing Kettles

Mixers
Impregnators
Dopp Kettles
Solvent Recovery &
Distillation Equipment

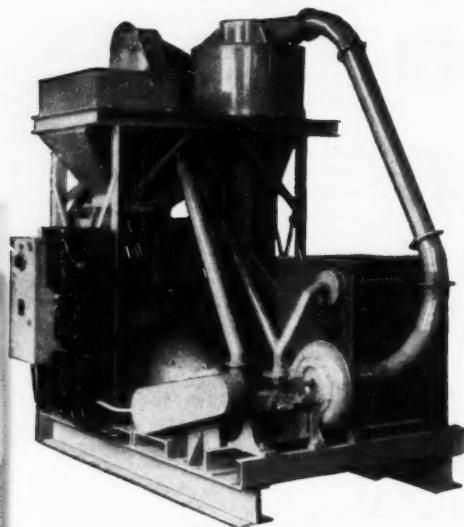


BUFLOVAK RESEARCH AND TESTING LABORATORY

To assist you in the solution of processing problems, BUFLOVAK offers the facilities of its Research and Testing Laboratory—where small scale experimental units show you, before you buy, the commercial possibilities, data on production cost, and characteristics of the finished product.

"PACKAGED PULVERIZERS"

for laboratory or
small operations

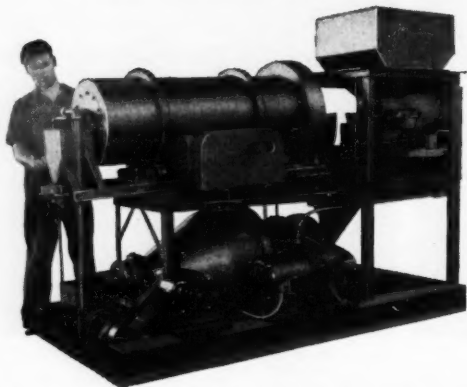


DRY- GRINDING UNIT

Make power connections only and the Hardinge Dry Grinding Unit is ready to perform. Self-contained and portable, 8' high. Complete with Constant-Weight Feeder, Conical Mill, Loop Classifier, dust collector, product collector and "Electric Ear" grinding control.

Bulletin AH-373-11.

WET-GRINDING UNIT



Make power and water connections only and the Hardinge WET GRINDING UNIT is ready to perform. Self-contained and portable, 8½' high. Includes Conical Mill, Counter-Current Classifier, launders, feeder, pump and "Electric Ear" grinding control.

Write for Bulletin AH-373-11.

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READERS' VIEWS, cont. . .

will be available to educational institutions.

ROBERT M. HUBBARD

Professor of Chemical Engineering
University of Virginia
Charlottesville, Va.

► Students and educational institutions can get their reprints at a reduced rate (see p. 414).

This is one of the many letters we've received from people teaching chemical engineering or process control instrumentation. From what we gather, our Guide Chart will be pretty widely used in schools and colleges throughout the country.—Ed.

How to Get Reprints

Sir:

I wish to inquire if reprints of your series of articles on Process Instrumentation and the Guide to Process Instrument Elements are for sale? This excellent compilation is valuable for those of us teaching courses in process measurements and control.

R. J. ALTPETER

Professor of Chemical Engineering
University of Wisconsin
Madison 6, Wis.

► Yes, we do have reprints of the Process Instrumentation report as well as Part 2, the Guide to Process Instrument Elements. These may be bought separately or as a unit.

For details on the price of these reprints, see our ad on p. 414. —Ed.

More of the Same

Sir:

We have found the folded chart, Chemical Engineering Guide to Process Instrument Elements, of great interest. If possible we should like to obtain more copies for use in other departments of our organization.

B. R. DORSEY

Manager
Venezuela Gulf Refining Co.
Barcelona, Venezuela, S.A.

Sir:

This has been a colossal job. May we cite your Instrument Elements chart in the bibliography section of our next bulletin?

JAMES L. McFADDEN

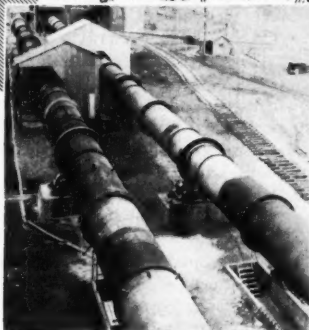
Gow-Mac Instrument Co.
Newark 5, N. J.

Sir:

Please accept my congratulations for one of the most complete and

Battery of old kilns

in this 1888 cement plant now lies in ruins. Each kiln produced only 100 barrels of clinker weekly . . . was soon made obsolete by the rotary kiln with its continuous production.



In meeting the needs of the chemical processing industry for 50 years, Traylor engineers have developed equipment to realize the greatest efficiency from new methods of production. It is this experience, built into every Traylor machine, that assures dependable production of a uniform, high-quality product. Depend on experience to relieve your production worries. Depend on Traylor experience . . . half a century of it.

Each Traylor Rotary Kiln is designed to fit a particular job. Send for Bulletin 115 to see what Traylor Kilns can do for you.



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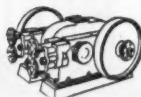
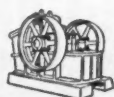
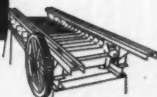
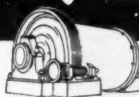
SALES OFFICES: New York • Chicago • San Francisco

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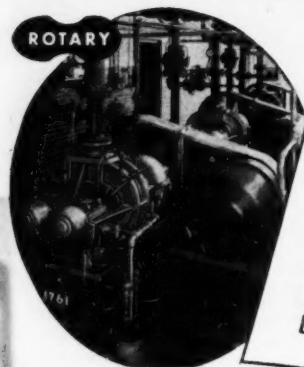
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leads to greater profits



No more "off the cuff" decisions when you compare blower values



Type RCG Rotary Positive Gas Pump,
capacity 269 cfm, used in chemical
manufacturing.

- ☐ Choice of Rotary or Centrifugal
- ☐ Capacity matched to the job
- ☐ Easy accessibility
- ☐ Ruggedness
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- ☐ Freedom from breakdowns
- ☐ Low maintenance costs
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- ☐ Proved reputation of maker
- ☐ Customer satisfaction

If you are considering new equipment for handling gas or air, we suggest you examine the essential values listed above, before you make your final selection. These factors will help you determine the unit that will best match your specific application, and that will give you the most satisfactory, economical performance.

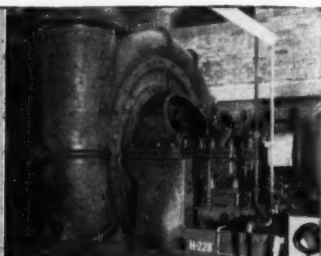
You'll find that R-C equipment rates high in every one of these essential factors. With capacities ranging from 10 cfm to 100,000 cfm or higher, at moderate pressures, and with the exclusive *dual-ability* line of Centrifugal or Rotary Positive types, you have a wide choice to meet the most exacting needs.

If you'd like to tell us about your specific problem, we'll gladly send detailed information for comparison, or supply engineering help from our 98 years of blower building experience.

ROOTS-CONNSVILLE BLOWER CORPORATION
522 Illinois Avenue, Connersville, Indiana



Type OIB Centrifugal Blower
in chemical processing plant.
Motor driven, capacity
19,600 cfm.



Reg. U. S. Pat. Off.

ROOTS-CONNSVILLE

ONE OF THE DRESSER INDUSTRIES



READERS' VIEWS, cont. . .

comprehensive and excellent jobs of explaining instruments, processes and construction, that I have ever seen or heard of.

H. F. BARRETT

Buffalo Meter Co.
Buffalo 14, N. Y.

Sir:

Your magazine is to be complimented on . . . the Chemical Engineering Guide to Process Instrument Elements. It represents a forward step in the correlation of a great deal of literature which has come out in recent years on instrumentation.

I should appreciate information on securing reprints for use of the members of our staff.

VICTOR ALBRECHT

Chemical Corps Materiel Command
Baltimore, Md.

Plastic-Fortified Concrete

Sir:

In the May issue of *Chemical Engineering* (p.238) you published an item under the New Products section about plastic-fortified concrete wherein you mentioned California Texas Oil Co. as the manufacturer.

I developed this new material while I was a graduate student at the Massachusetts Institute of Technology; the California Texas Oil Co. is not in any manner connected with this product. I am presently working for this company and using it as my official address, which probably gave rise to the misinterpretation. Inquiries should be sent directly to me and not to any department of the company.

I would appreciate it very much if this correction is made in your magazine as the California Texas Oil Co. is being swamped with letters of inquiry on this subject . . . imposing an undue burden on its staff.

SEVERO P. AMAGNA

California Texas Oil Co., Ltd.
New York, N. Y.

► We regret our slip-up and the inconvenience this has caused California Texas and Reader Amagna.

The little 11-line item we published in May evidently pulled plenty of attention: our own telephone operators have commented about the flood of calls that came directly to us.

If you want more information on Mr. Amagna's plastic material for fortifying cement, please address him personally at California Texas Oil Co., Ltd., 551 Fifth Ave., New York 17.—Ed.

Coming in September

• Don't miss next month's feature report on petrochemical processes. You'll see this industry organized as it should be—around unit processes.

• Do you sometimes make cost estimates? Then you'll find September's article on the "language" of cost estimates right down your alley.

• What can the infrared analyzer do to help you control your plant processes? Plenty—and next month's article will tell how.

• Also coming soon: how to do tricks with thermostats, chemicals from acetylene and ethylene, a new slant on market research.

LITTLE BONER



One Way to Do It

It was a hot, sticky day—such as we've been having recently—and the young operator had just one thought in mind: What he would give to have that day off!

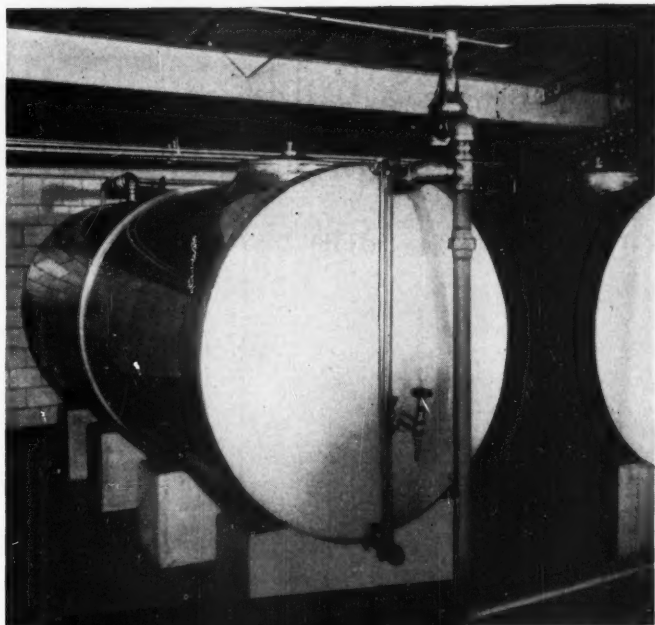
Visions of a cool swimming pool kept coming up as he pulled the reaction solution from a feed tank into the still pot. When the feed tank was empty, he applied vacuum to the pot.

Then something happened to break the visions of the swimming pool: Instead of getting the low vacuum he was accustomed to seeing, the gage went right down to zero. He checked around for over an hour to find out what was wrong, then gave up and called his foreman.

The foreman took just one look into the still pot, then promptly gave the operator the day off.

He had forgotten to close the drain valve.

Why not send in your true "little boner"? Address the Editor, *Chemical Engineering*, 330 West 42nd St., New York 36, N. Y.



Aluminum is Noncoloring

Aluminum Saves 50 to 80%

Aluminum will not discolor products that are processed in it. This is also true of a few other metals. But when you check prices, you see that aluminum offers tremendous savings. Copper for example, costs twice as much. In the case of stainless steel, aluminum saves about 80 per cent.

These two facts have led process engineers to specify aluminum equipment for the processing of such fussy compounds as acetic acid, naval stores and hydrogen peroxide. Such products are also shipped in aluminum tank cars and drums . . . stored in aluminum tanks.

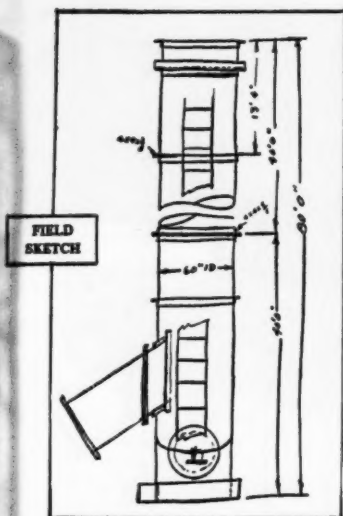
Alcoa's development engineers have firsthand experience with hundreds of such applications. To get in touch with them, simply write (on your company letterhead) to:



ALUMINUM COMPANY OF AMERICA
1860-H Gulf Building • Pittsburgh 19, Pennsylvania

ALCOA first in ALUMINUM

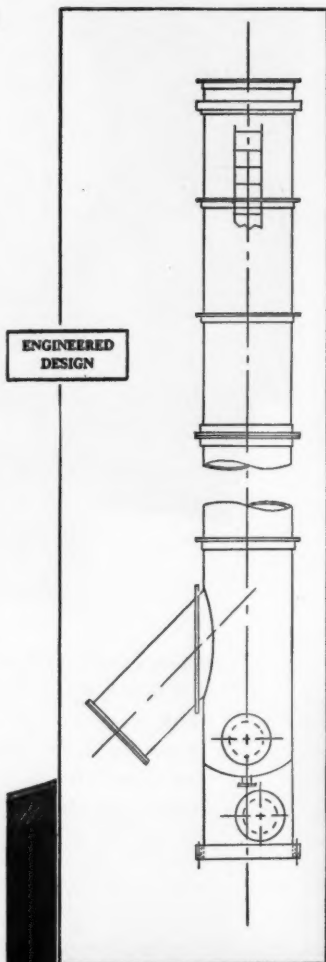
How U. S. Rubber's complete engineering service combats corrosion



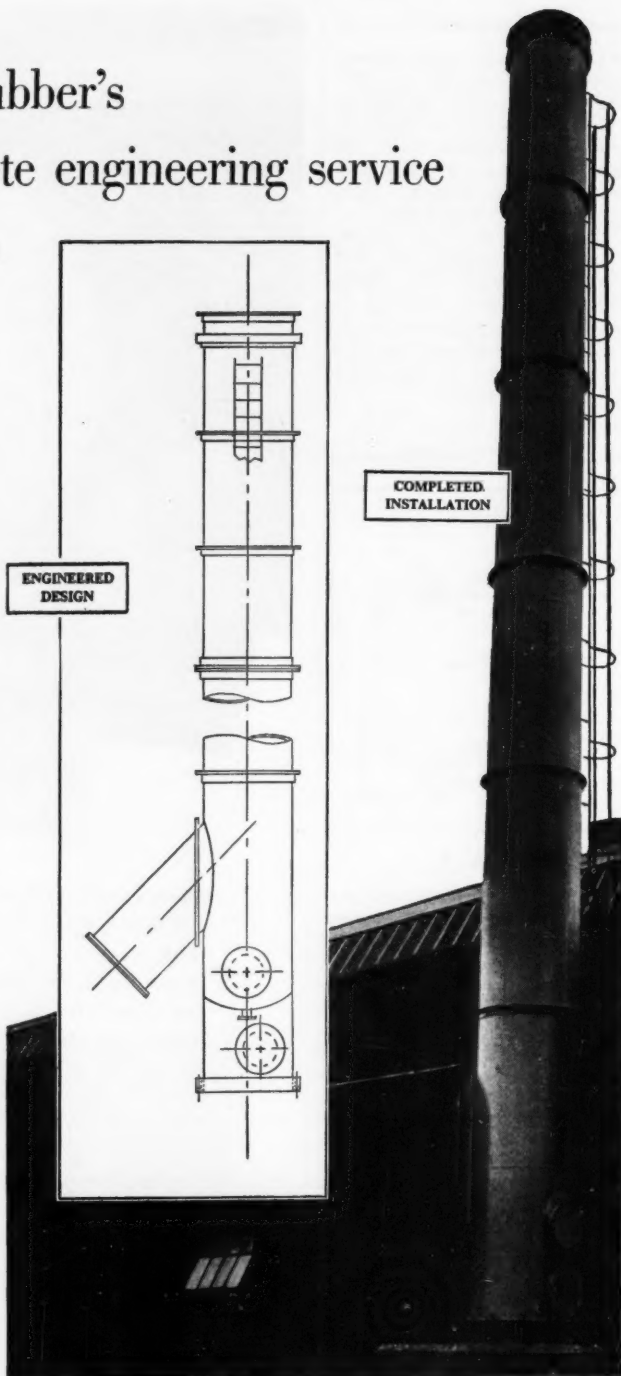
This steel mill was faced with the difficult problem of exhausting corrosive gases resulting from its pickling operations. A U.S. Rubber engineer was consulted, and he designed this rubber-lined steel stack. 80 feet high and 5 feet in diameter.

Fabricated, rubber lined and installed under his supervision, its successful operation serves as one more positive example of the complete engineering service available to industry to combat corrosion. Write to address below.

PRODUCT OF



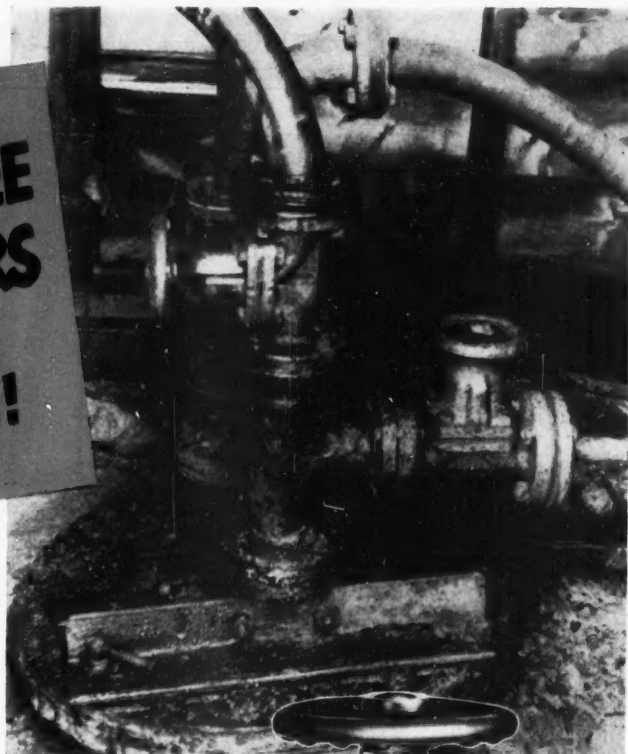
COMPLETED
INSTALLATION



UNITED STATES RUBBER COMPANY
MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

**TROUBLE FREE
FOR 15 YEARS**
handling
muriatic acid!

Another
'open and closed'
case for



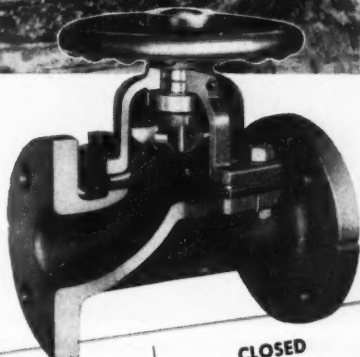
GRINNELL-SAUNDERS DIAPHRAGM VALVES

In 1936, a Canadian mine installed Saunders Diaphragm Valves with rubber linings on the feed and drain piping of an underground tank used for the storage of muriatic acid. Today, after 15 years, those same valves are in use—having required no maintenance except for periodic replacement of diaphragms, a simple operation done without removing the valve from the line.

Grinnell-Saunders Diaphragm Valves are available in many different combinations. Bodies are made in a variety of metals—iron, stainless steel, bronze, aluminum and others. *But of more importance* is the fact that a body of cast iron (a metal not in short supply) can be lined with glass, lead, natural rubber, neoprene and other materials which, in many instances, handle corrosive fluids *better* than metals.

Diaphragms come in natural rubber, neoprene, butyl, hycar, a special synthetic for foods and KEL-F. This last is chemically inert to all acids and alkalis in all concentrations with the exception of molten alkali metals.

From this broad selection of materials, the problems which the Grinnell-Saunders valve can solve are extremely varied. No wonder industry after industry is putting it on the line.



OPEN



No packing glands to demand attention. Working parts isolated from fluid...sticking, clogging, contamination, corrosion eliminated.

CLOSED



Compressor or finger plate supports the diaphragm in all positions. No metal-to-metal seats to become damaged or wire-drawn.

GRINNELL

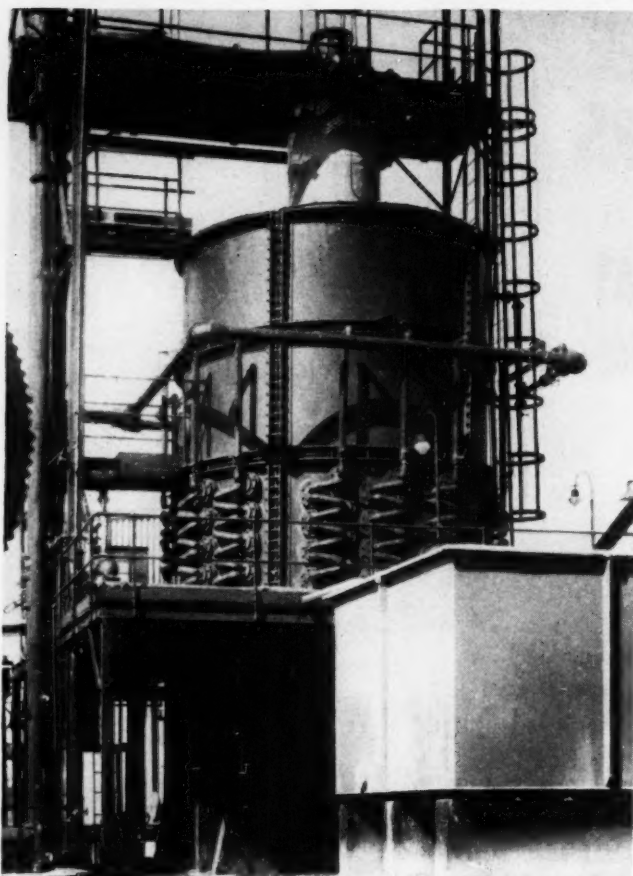
WHENEVER PIPING IS INVOLVED



Grinnell Company, Inc., Providence, Rhode Island

Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
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industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



Simonson-Mantius sulphuric acid concentrator with Hastelloy alloy D heater tubes.

Hastelloy Alloy D

The corrosion resistance of this nickel-silicon-copper alloy to a number of corrosives, with data on mechanical properties and applications in the CPI.

EDWARD D. WEISERT
Haynes Stellite Co., Kokomo, Ind.

Hastelloy alloy D is a nickel-base alloy containing 8.5 to 10.0 percent silicon and 3.85 to 4.25 percent copper as the major alloying elements. It is best known for its exceptional re-

sistance to sulphuric acid of all concentrations and at all temperatures—even up to the boiling point. However, the alloy also has good resistance to many other corrosive media, such as

phosphoric acid, organic acids, and acid-salts. It is available in cast form only.

The chemical composition of Hastelloy alloy D is given in Table I, and mechanical properties in Table II. Table III gives hardness values obtained from sand-cast step blocks. You will notice that the hardness of an alloy D casting varies with the thickness of the cross section, and can be controlled by heat-treatment. Annealing the cast material lowers the hardness somewhat, but increases the toughness of the alloy.

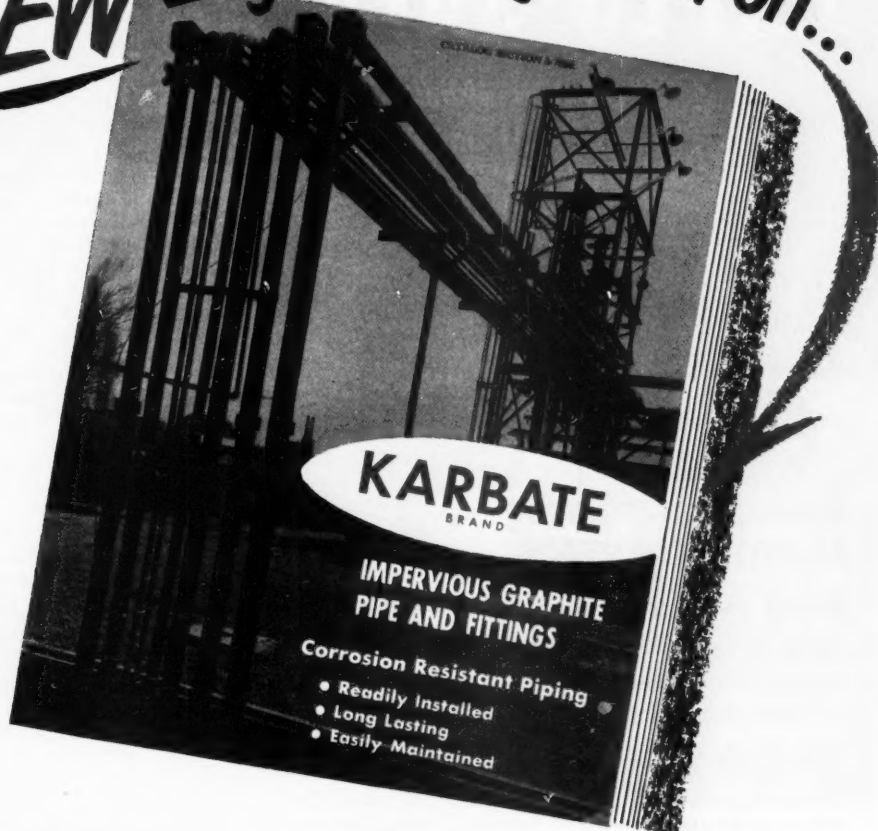
The microstructure of Hastelloy alloy D consists of a nickel-rich solid solution matrix, interspersed with a nickel silicide phase. The hardness of this latter phase accounts for the good abrasion resistance of the alloy. This property is of particular advantage in such applications as pump parts, where the shaft must resist packing wear. Alloy D balls are used as check valves for pumps that handle the yield from corrosive or sandy oil wells. In this application, a combination of abrasion resistance and corrosion resistance is required.

WITH SULPHURIC ACID

As has already been indicated, the most outstanding use of Hastelloy alloy D is for equipment used in concentrating sulphuric acid. In the Simonson-Mantius type of concentrator, for instance, Hastelloy alloy D heating tubes are widely used. These tubes are used to introduce high-pressure steam or Dowtherm into the vats to heat the acid. Because alloy D has high strength and good resistance to thermal shock, it can handle the high condensing temperature of Dowtherm, and steam can be introduced under a pressure of 300 psi. With other tube materials, a maximum pressure of only 100 psi. is possible. Alloy D tubes have also been used with marked success to introduce hot gases into the acid bath in the Chemico-type concentrator.

Another successful application of Hastelloy alloy D is in pumps that handle solutions or sludges containing sulphuric acid. Many leading pump manufacturers have had considerable experience in machining the alloy and

NEW Engineering Data on...



- PHYSICAL PROPERTIES
- AVAILABLE SIZES
- TYPES OF CONNECTIONS
- STANDARD FITTINGS
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point to "Eveready" No. 1050 Industrial Flashlight Batteries... the cells that deliver *twice* as much usable light as any battery we've ever made before. Their unique construction prevents swelling or jamming in the case... has no metal can to leak or corrode.

The terms "Karbate" and "Eveready" are registered trade-marks of Union Carbide and Carbon Corporation

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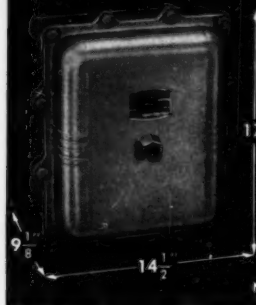
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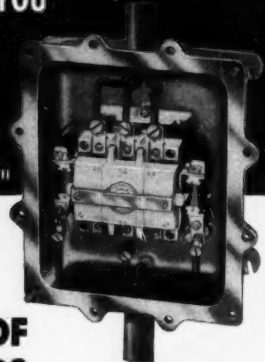
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OF REAL IMPORTANCE
TO YOU



SIZE 3
NEMA TYPE VII



SIZE 3 UNIT
Height 8"
Width 9"
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Bring you these Important Advantages:

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Plus - Simplified Wiring

Exclusive, Straight-Thru, Front Wiring offers time, space and labor savings up to 30%. Crossing and U-bending necessary with old-fashioned "scrambled wiring" are completely eliminated. All terminals and contacts are easy to reach, easy to wire and service. Installations are faster and neater; maintenance is simple and economical. Direct routing is safer and makes circuit identification fast and positive.

AVAILABLE IN SIZES 0, 1, 2, 3 and 4 WITH NEMA TYPES IV, V, VII AND IX ENCLOSURES. EXPLO-SAFE Push Button Stations can be supplied for every circuit requirement up to 600 volts A.C.

Send today for this fully illustrated booklet which explains why EXPLO-SAFE Starters are best suited for Chemical Processing Industries. Complete with dimensional and rating data. There is no cost or obligation.

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CORROSION FORUM, cont. . .

can supply a variety of pumps for such service. Because of its hardness, the alloy is somewhat difficult to machine; but most machining operations can be performed with tungsten carbide tools.

PROTECTIVE FILM FORMED

The high resistance of Hastelloy alloy D to the corrosive effects of sulphuric acid depends to a great extent upon the formation of a protective sulphate film. This film requires some time to build up. Thus, in considering the corrosion rates in sulphuric acid presented in the temperature-concentration charts that follow, it should be kept in mind that the results are based on 18-hr. laboratory tests. For example, the corrosion rate shown for the alloy in boiling 77 percent sulphuric acid is 0.18 in. per year. When the same tests were extended to 70 hr., however, the rate of attack was only 0.08 in. per year. This lower rate is the result of the formation of the sulphate film.

Another thing to remember is that the charts are limited in scope. Naturally, they do not take into account all the many factors that must be considered, in addition to temperature and concentration, for a particular application. In preparing the charts, the boiling points of all solutions were plotted as 212 deg. F., the normal boiling point of water. Also, in complex mixtures, where the exact concentration of the main corrosive agent was not known, the 100 percent concentration line was used.

Table I—Composition Ranges for Hastelloy Alloy D

Si	—8.5 to 10.0 percent
Cu	—3.85 to 4.25 percent
Mn	—0.80 to 1.25 percent
C	—0.12 percent max.
Cr	—1 percent max.
Fe	—1 percent max.
Ni	—Balance

Table II—Some Mechanical Properties of Hastelloy Alloy D

Ultimate tensile strength, psi	110,000-125,000
Elongation, percent in 1 in.	0-2
Reduction of area, percent	0-1.5
100-lb impact strength, ft.-lb.	1-2

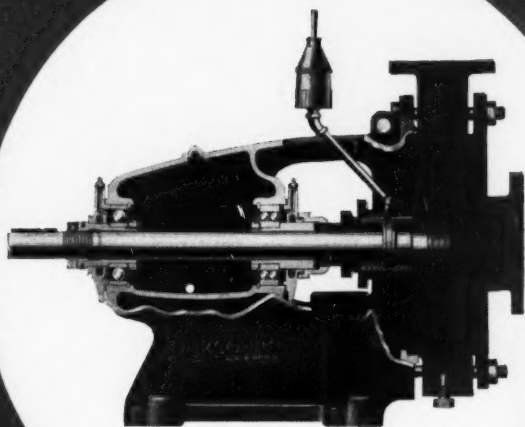
Table III—Hardness Data for Hastelloy Alloy D

Thickness, In.	Rockwell C Hardness	
	As-Cast	Annealed* (FC ²)
3	31	38
2	34	40
1	37	38
1/2	41	43
1/4	47	39

* 1,775 to 1,825 deg. F. for 3 hr.
cool (fan). ² Furnace cool.

¹ Rapid air

For tough Chemical Service



STANDARD
DURCOPUMPS
IN THESE
ALLOYS

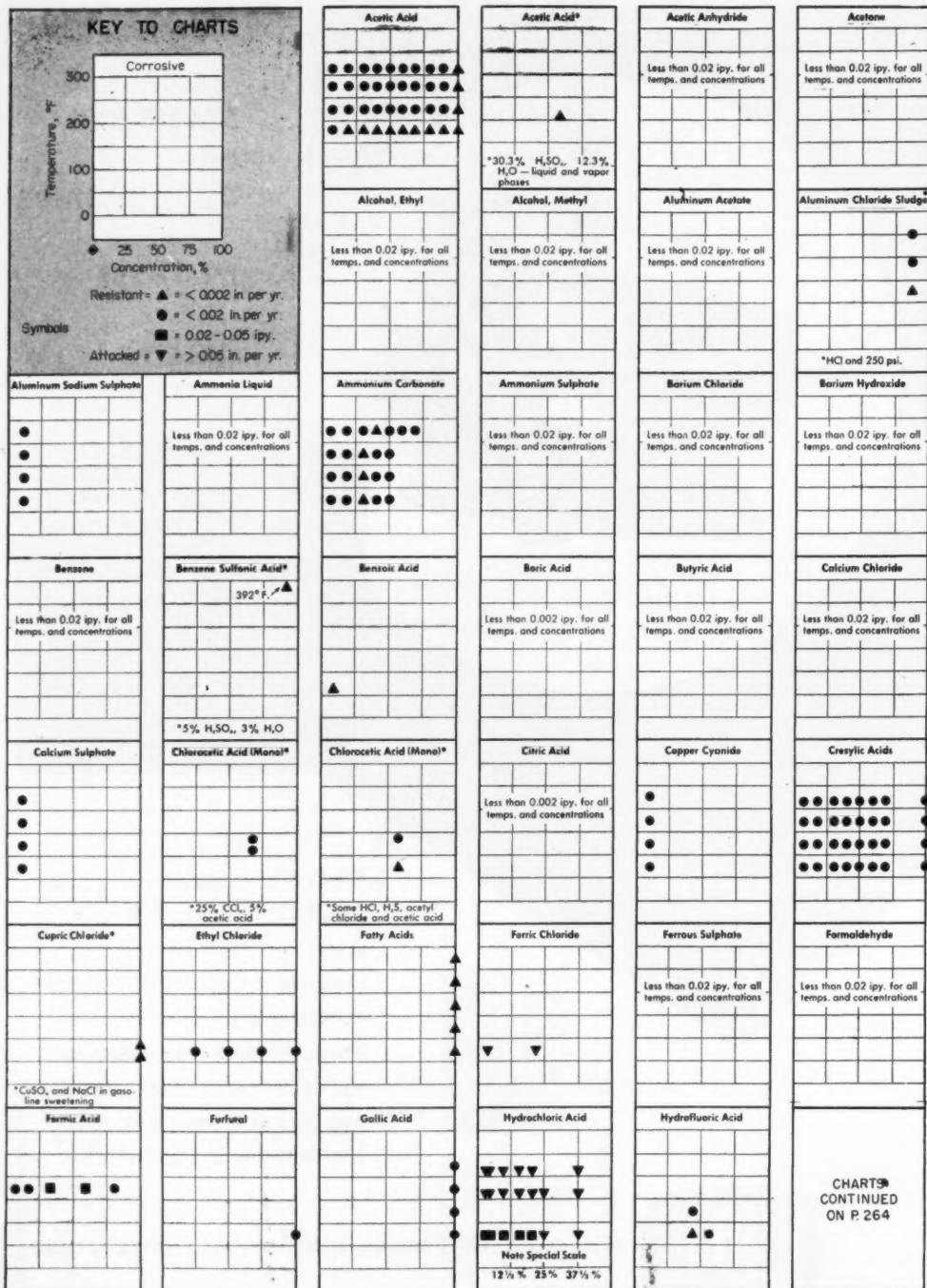
DURIRON	CHLORIMET 3
DURICHLOR	DURCO D-10M
DURIMET 20	MONEL METAL
DURCO 18-8-S	INCONEL
DURCO 18-8-S-Mo	NICKEL
CHLORIMET 2	NI-RESIST #2

Series R Durcopumps, designed and built to handle severe corrosives, are available in the alloys listed above as regular production items. For the details of construction and performance of industry's standard acid pumps, write for free Bulletins P/1 and 100B.

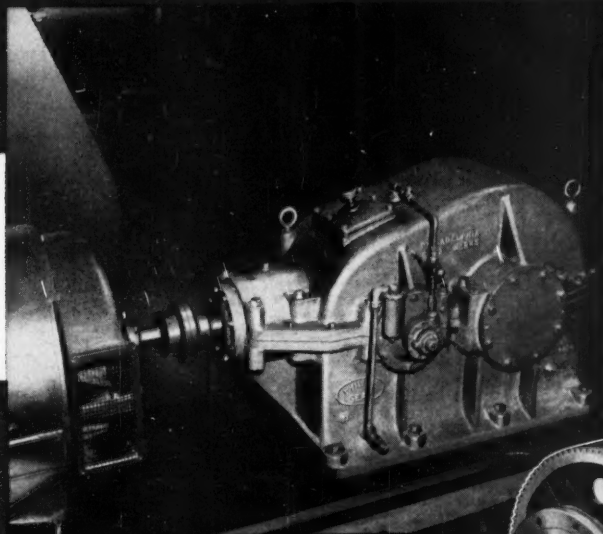


A product of THE DURIRON COMPANY, INC., DAYTON, OHIO

Corrosion Resistance of Hastelloy Alloy D

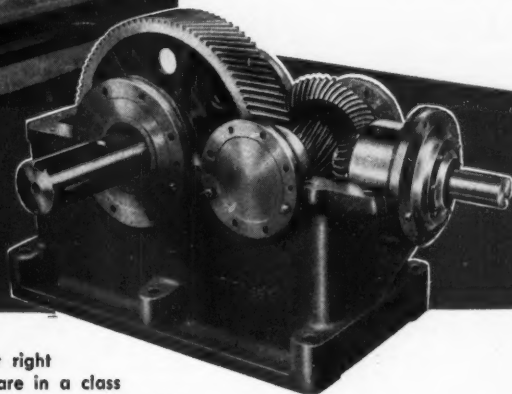


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Get them all in a
PHILADELPHIA
SPIRAL BEVEL-HELICAL
Speed Reducing Unit

- ☒ HIGH EFFICIENCY
- ☒ ECONOMICAL OPERATION
- ☒ COMPACT CONSTRUCTION
- ☒ QUIET RUNNING
- ☒ LONG SERVICE LIFE
- ☒ LOW MAINTENANCE



For smooth, dependable transmission of power at right angles Philadelphia Spiral Bevel-Helical Reducers are in a class by themselves. Designed and built by an established leader in the manufacture of power transmission equipment, these units are made to most exacting quality standards. Every part, from housings to bearings is manufactured from selected materials and produced on modern machinery.

Both horizontal and vertical units are available in single, double and triple reduction types. Standard ratios range from 1 to 1 up to 238 to 1. Operating efficiencies are as high as 98%.

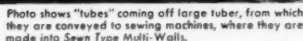
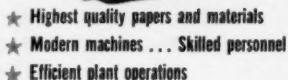
get our
catalog

Complete construction details are in our catalog SB-50. Write for a copy on your business letterhead.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

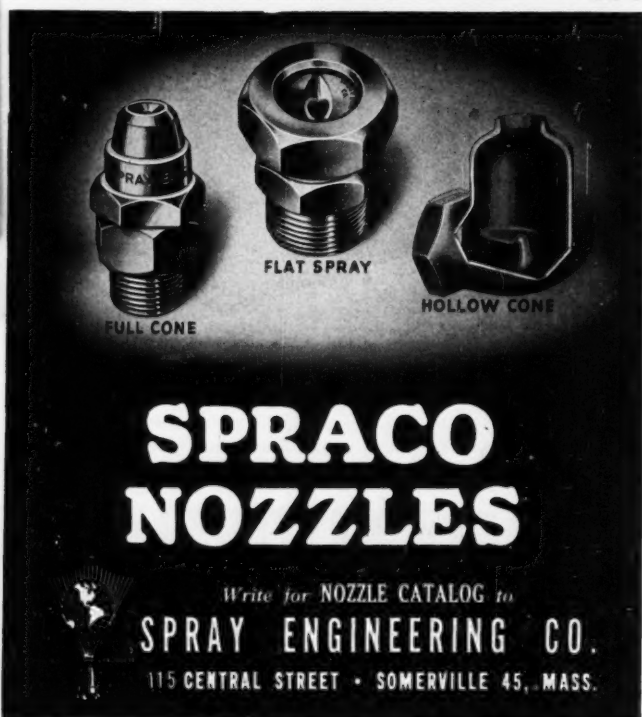
Industrial Gears and Speed Reducers
LimiTorque Valve Controls



Write for booklet—"To Serve You Better with Hammond Multi-Wall Bags."

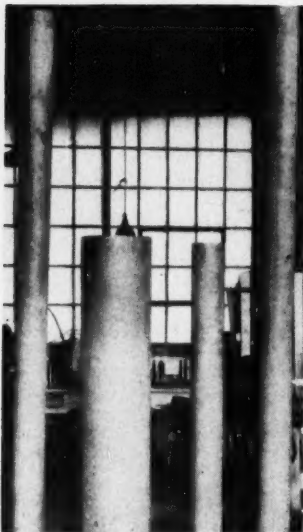
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General Offices: Wellsburg, W. Va. • Plants in Wellsburg, W. Va. and Pine Bluff, Ark.




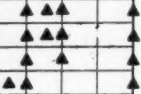




CORROSION FORUM, cont. . .


Hastelloy D (key on p. 262)



Hastelloy D dip-type heating tubes.

Hydrofluosilicic Acid*	Lactic Acid
	<p>Less than 0.02 ipy. for all temps. and concentrations</p>
*22% HF, 0.06% H ₂ SO ₄	
Lithium Hydroxide	Magnesium Carbonate
	
Magnesium Chloride	Magnesium Sulphate
	
Mercury	Methanol
	<p>Less than 0.02 ipy. for all temps. and concentrations</p>

(Continued on page 266)

You can't stop a raging fire with a garden hose 



You can't stop corrosion with ordinary paints . . .
it takes BITUMASTIC COATINGS!

CORROSION can't be stopped by ordinary paints or conventional protective coatings . . . they can't protect surfaces against the ravages of rust for any appreciable length of time.

But Bitumastic Coatings can!

FIRST—Unlike maintenance paints, Bitumastic® Protective Coatings are specially formulated from a base* of coal-tar pitch that is, for all practical purposes, impervious to water. When you keep moisture away from an exposed surface, you *stop* corrosion.

FURTHER—Bitumastic Coatings provide an extra-tough, extra-thick barrier against corrosive elements—a barrier that is impenetrable. And these coatings provide up to 8 times the film thickness of conventional paint coatings.

FINALLY—Bitumastic Coatings stop corrosion caused by moisture—acid fumes—alkaline fumes—corrosive soil—salt air—heat.

There are 6 Koppers Coatings—formulated to control corrosion of metal and deterioration of concrete. Use the coupon for full information.

*Hi-Heat Gray contains a metallic base.

— SEND FOR SET OF FREE BOOKLETS! —

Koppers Company, Inc., Tar Products Division
 Dept. 859-T, Pittsburgh 19, Pa.

Please send me, without charge or obligation, your booklets on corrosion prevention.

Name.....

Address.....

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BITUMASTIC PROTECTIVE COATINGS

SOLD THROUGH
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KOPPERS COMPANY, INC., Tar Products Division, Dept. 859-T, Pittsburgh 19, Pa.

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*These Companies Had -
and look what PANGBORN
did for them !!*



This one Pangborn installation solved six dust control problems for Kingsbury Machine Tool Co., Keene, N.H. Heating costs have been lowered substantially through recirculation of cleaned air, costly dust damage to machinery and products has been prevented, and workers' efficiency has increased!

working conditions, removing dust hazards, improving community relations, saving money through reclamation and salvage of the dust collected—these are Pangborn's stock-in-trade—these are the benefits literally thousands of plants are enjoying, thanks to Pangborn.

What are your Dust Problems? Find out what Pangborn can do to solve them. Write for Bulletin 909A. Address: PANGBORN CORP., 2600 Pangborn Blvd., Hagerstown, Md.

Look to Pombora for the latest developments in Dust Control and Blast Cleaning equipment

Pangborn

DUST CONTROL

STOPS THE DUST HOG from stealing profits

Hastelloy D (key on p. 262)

Notice . . .

Coming:

Carbon & Graphite, September 1952

Polyethylene, October 1952

Already Published:

Furane Cements, December 1951

Phenolic Cements, January 1952

Sulphur Cements, February 1952

Silicate Cements, March 1952

Tantalum, April 1952

Aluminum, May 1952

Hastelloy C, June 1952

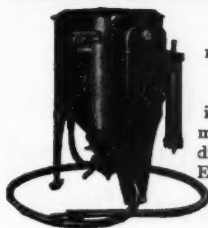
Hastelloy B, July 1952

Naphthalene Sulfonic Acid ^a	Naphthalene Sulfonic Acid ^a
^a 30-93% H ₂ SO ₄ —sulfonation of naphthalene	^a Condensation with formaldehyde
Nitriding Gases	Oxalic Acid
Less ^b than 0.02 ipy. for most temperatures encountered	Less than 0.02 ipy. for all temps. and concentrations
Phenol	Phosphoric Acid, C.P.
Less than 0.02 ipy. for all temps. and concentrations	● ● ■ ▼
	▲ ▲ ▲ ▲
Phosphoric Acid, Tech.	Potassium Carbonate
● ● ■ ■	Less than 0.02 ipy. for all temps. and concentrations
● ● ● ●	
Potassium Chromate	Potassium Hydroxide
	Less than 0.02 ipy. for all temps. and concentrations
▲	

CHEMICAL ENGINEERING—August 1952

**Here's
BIG
NEWS**

Hydro-Finish SPEEDS POLISHING!



Removes scale, and directional grinding lines . . . prepares surfaces for plating and holds tolerances to .0001"! Liquid blast reduces costly hand cleaning and finishing of molds, dies, tools, etc. Models from \$1410.00 and up

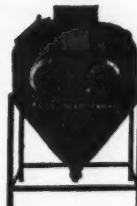


STOP DUST
at the SOURCE!

COMPACT Blast Cabinet
for SMALL WORK!



Pangborn industrial type Unit Dust Collectors trap dust at source. Machine wear is minimized, housekeeping and maintenance costs reduced. Solves many grinding and polishing nuisances and material losses. Models from \$286.00 and up



Ideal for producing smooth, clean surfaces on pieces up to 60" x 36" in size. Cleans metal parts, removes rust, scale, grime, dirt, paint, etc., in a few seconds. Saves money all year round. Models from \$319.00 up

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control Equipment

Pangborn

**MAIL
COUPON
FOR DETAILS**

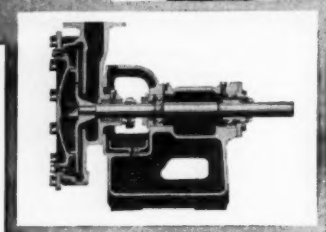
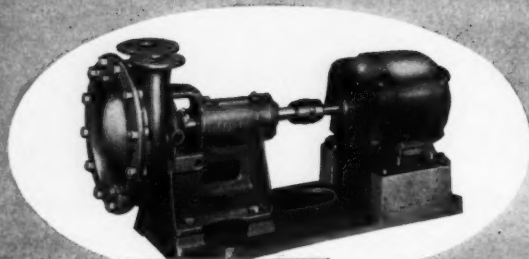
Check for more
information

- ☐ Blast Cleaning Cabinets
- ☐ Blast Cleaning Machines
- ☐ Unit Dust Collectors
- ☐ Hydro-Finish Cabinets

PANGBORN CORP., 2600 Pangborn Blvd., Hagerstown, Md.
Gentlemen: Please send me more information on the equipment
I've checked at the left.

Name.....
Company.....
Address.....
City..... Zone..... State.....

For economy in handling corrosive liquids...



With the stuffing box on suction side of impeller, pressure on it is limited to the suction head only, assuring long packing life and freedom from excessive leakage. Interior of pump can be inspected and cleaned and impeller can be removed or replaced without disturbing the piping.

specify **GOULDS** stainless steel centrifugal **PUMPS**

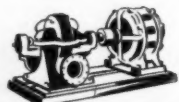
Other GOULDS PUMPS for processing plants



This highly efficient Goulds single stage centrifugal pump (Fig. 3169) is well suited for general processing purposes. Ten sizes.



Nonclogging impeller of this vertical sump pump (3047) will handle water containing large solids or fibrous materials.



For capacities up to 15,000 G.P.M. Heads up to 500 ft. Check the specifications of this Goulds ball bearing double suction centrifugal (3450).

One plant engineer reports better than a seventy-five percent cost saving by handling an especially erosive slurry with Goulds Fig. 3705 Stainless Steel pumps. The pumps previously used not only cost almost four times as much as the Goulds pumps, but the Goulds pumps have already been in service over twice as long.

The entire fluid end of this Goulds Fig. 3705 pump is of stainless steel mounted on a cast iron support. It is regularly carried in stock in No. 316 and FA 20 stainless steels, but other metals and alloys can be supplied for all parts coming in contact with the liquid.

This pump has several features that contribute to economical, 24-hour service with acid and alkaline liquors which quickly corrode standard iron or bronze pumps. Bulletin 725.3 describes this Goulds unit in detail. We will be glad to send you a copy.



CORROSION FORUM, cont. . .

NACE South Central Region Meeting: Preliminary Technical Program

Design against corrosion and engineering approaches to the solution of corrosion problems will be the principal themes of the technical program of the South Central Region's three-day meeting which is to be held at the Jung Hotel in New Orleans, Oct. 1-3.

The program projected, officials, and the titles of papers and names of authors arranged for so far are (partial list):

Wednesday, Oct. 1:

2:00 p.m.—Cotillion Room, report of TP-1H on Corrosion of Oil String Casing. Jack L. Battle, Humble Oil and Refining Co., Houston, chairman, presiding.

Thursday, Oct. 2:

9:00 to 11:45 a.m.—Tulane Room. Oil and Gas Industry Symposium. Edward C. Greco, Production Dept., United Gas Co., Shreveport, chairman; D. F. Dial, Production Department, Pure Oil Co., Houston, co-chairman; aides, D. A. Shock, Continental Oil Co., Ponca City, Okla. and Robert C. Booth, Shell Oil Co., Houston.

Mill Scale on Steel and Its Effect on Steel Corrosion in Salt Water, by T. P. May and R. B. Teel, The International Nickel Co., Inc., New York.

Bacterial Corrosion of Offshore Structures, by J. A. Caldwell and Mrs. M. L. Lytle of Humble Oil and Refining Co., Houston.

Review: Use of Sodium Chromates and Alkalis for Controlling Corrosion in Gas Condensate Wells, by Kenneth C. Eilerts, Dept. of Interior, Bureau of Mines, Bartlesville, Okla.

Oil Well Inhibition, by Frank C. Bird of the California Company, New Orleans.

Gasoline Plant Corrosion, by Maryann Duggan, Magnolia Petroleum Co., Dallas.

2:30 to 4:45 p.m.—Processing Plant Symposium. Sam Muery, Freeport Sulphur Co., Port Sulphur, La., chairman; Ray Cherry, Monsanto Chemical Co., Texas City, Texas, co-chairman; aides, Clyde C. Loyd, Esso Standard Oil Co., Baton Rouge, La., Alan Whitehead, Metal Goods Corp., New Orleans.

Oil Refinery Corrosion Problems, W. A. Trusty, Arkansas Fuel Oil Co.,

Hooker Chemical Guide (ONE OF A SERIES)

USE this handy reference to save time
in selecting high quality chemicals.

HOOKER TOLUENE DERIVATIVES

BENZYL CHLORIDE

Synonym: Alphachlorotoluene

Formula: $C_6H_5CH_2Cl$

Appearance: Clear, colorless to light yellow liquid.



TYPICAL PROPERTIES

Molecular Weight 126.5
Freezing Point $-43^{\circ}C$
Distillation Range (Refined) 5° or less incl. $179.4^{\circ}C$
Distillation Range (Tech.) ... 6° to 10° incl. $179.4^{\circ}C$
Specific Gravity (Refined), $15.5^{\circ}/15.5^{\circ}C$ 1.107
Specific Gravity (Tech.), $15.5^{\circ}/15.5^{\circ}C$ 1.106

USES

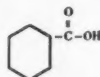
Intermediate: Chemicals, dyestuffs, rubber accelerators, gasoline gum inhibitors, perfume bases, plasticizers, resins, wetting agents, pharmaceuticals.

BENZOIC ACID

Synonym: Phenylformic Acid

Formula: C_6H_5COOH

Appearance: White, odorless, crystalline solid. USP grade in powdered form; Technical grade in powdered or bead form.



TYPICAL PROPERTIES, USP GRADE

Molecular Weight 122.1
Melting Point $122.0^{\circ}C$
Benzoic Acid 99.3% Min.
Water 0.2% Max.

USES

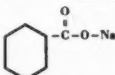
Intermediate: Dyes, pharmaceuticals, perfumes.
Textile: Dyeing assistant, dye stripping agent, preservative for sizing.
Preservative: Foods, cosmetic creams, lotions, tobacco.

SODIUM BENZOATE

Synonym: Benzoate of Soda

Formula: C_6H_5COONa

Appearance: White, odorless, crystalline solid in flake or powdered form. Available in USP or Technical grades.



TYPICAL PROPERTIES, USP GRADE

Molecular Weight 144.1
Sodium Benzoate 99+ %
Benzoic Acid 0.2% Max.
Water 0.5% Max.

USES

Preservative: For foods such as tomatoes, fruit juices, syrups, margarine; also preservative for pharmaceutical and cosmetic preparations, tooth paste.
Corrosion Inhibitor: For glycol anti-freeze solutions, chlorinated solvent type metal cleaners, etc.
Chemical Intermediate: Dyestuffs and pharmaceuticals.

BENZOYL CHLORIDE

Formula: C_6H_5COCl

Appearance: Clear, colorless liquid.



TYPICAL PROPERTIES

Molecular Weight 140.5
Freezing Point $-0.9^{\circ}C$
Boiling Point $198^{\circ}C$
Specific Gravity, $15.5^{\circ}/15.5^{\circ}C$ 1.219

USES

Chemical Intermediate: Introduce benzoyl group into organic compounds.
End Products: Benzoyl peroxide, benzophenone and benzyl benzoate.
Derivatives: Include polymerization catalysts, bleaching agents, perfumes, dyes and pharmaceuticals.

BENZOTRICHLORIDE

Synonyms: Alphatrachlorotoluene

Phenyl Chloroform

Formula: $C_6H_5CCl_3$

Appearance: Clear, colorless liquid.



TYPICAL PROPERTIES

Molecular Weight 195.5
Freezing Point $-5^{\circ}C$
Distillation Range 219° to $223^{\circ}C$
Specific Gravity, $15.5^{\circ}/15.5^{\circ}C$ 1.380

USES

Intermediate: Chemicals and dyestuffs.

MONOCHLOROTOLUENE

Synonym: Methylchlorobenzene

Formula: $CH_3C_6H_4Cl$

Appearance: Clear, colorless to straw colored liquid.



TYPICAL PROPERTIES

Molecular Weight 126.5
Freezing Point below $-45^{\circ}C$
Distillation Range 158.3° to $161.7^{\circ}C$
Specific Gravity, $15.5^{\circ}/15.5^{\circ}C$ 1.080

USES

Solvent: Rubber and synthetic resins.
Intermediate: Manufacture of rubber accelerators, chemicals.

For more information on items listed, drop a note on your letterhead to HOOKER ELECTROCHEMICAL COMPANY, 5 Forty-Seventh St., Niagara Falls, N. Y.

HOOKER ELECTROCHEMICAL COMPANY

NIAGARA FALLS, N. Y. • TACOMA, WASH. • WILMINGTON, CALIF.

From the Fall of the Earth



2-538

INVESTIGATE THE UNUSUAL PROPERTIES OF

BARBER GILSONITE

A NATIVE ASPHALTITE,

Barber Gilsonite is hard, glossy,
brittle, and has an extremely
high melting point. Chemically inert,
Barber Gilsonite may have important
values in your processes. We'll be glad
to supply samples and specific data
promptly on receipt of your request.

5

USEFUL GRADES

BARBER GILSONITE SELECTS L
Melting Point Range 270-300° F.

BARBER GILSONITE SELECTS PULVERIZED
Melting Point Range 280-310° F.

BARBER GILSONITE SELECTS VB
Melting Point Range 325-365° F.

BARBER STANDARD GILSONITE S
Melting Point Range 280-310° F.

BARBER STANDARD GILSONITE E
Melting Point Range 335-375° F.

IMPORTANT INDUSTRIAL USES

BUILDING MATERIALS • Barber Gilsonite is used as an important ingredient in building materials: floor tiles; building boards and paper; protective coatings and roofing lines.

MOLDED PRODUCTS • Barber Gilsonite is a principal component in battery cases and other thermoplastic molded products.

ELECTRICAL PARTS • For its high insulating value, Barber Gilsonite has wide application in electrical products and insulating varnishes.

SPECIAL APPLICATIONS
Wax and rubber compounds
Printing inks • Sounds and weather-proofing materials • Pipe coatings • Chassis paints • Brake and clutch linings.

AMERICAN Bitumuls & Asphalt COMPANY

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CORROSION FORUM, cont. . .

Shreveport.

Plastic Materials of Construction
by R. B. Seymour, Atlas Mineral
Products Co., Mertztown, Pa.

Designing to Prevent Corrosion, by
Fred A. Prange, Phillips Petroleum
Co., Bartlesville, Okla.

Statistics, A Useful Tool for the
Examination of Corrosion Data, by
C. F. Lewis, Cook Heat Treating Co.,
Houston.

Friday, Oct. 3:

9:00 to 11:45 a.m.—Oil and Gas
Transportation Symposium. K. D.
Wahlquist, Southern Union Gas Co.,
Dallas, chairman; F. E. Pyeatt, Jr.,
Mid-Continent Pipe Line Co., Tulsa,
co-chairman; aides, J. A. Holloway,
Houston Pipe Line Co., Edna, Texas;
Sidney Trouard, Jr., New Orleans
Public Service, Inc., New Orleans.

Pipe Line Coatings, by F. W. Fair,
Jr., Koppers Co., Pittsburgh.

A New Development in Magnesium
Anodes for Pipe Line Cathodic Pro-
tection, by R. C. Jorgerson and Burke
Douglas, Dow Chemical Co., Free-
port, Tex.

Cathodic Protection of Uncoated
Pipe Lines, by Joe F. Tatum, Will-
mut Gas and Oil Co., Hattiesburg,
Miss.

The Tank Ship and Its Corrosion
Problems, by J. D. Sudbury and D. A.
Shock, Continental Oil Co., Ponca
City, Okla.

Inspection of Transportation Equip-
ment to Prevent Corrosion and Fail-
ure in Use, by Geo. L. C. Dehn, Mag-
naflux Corp., Dallas.

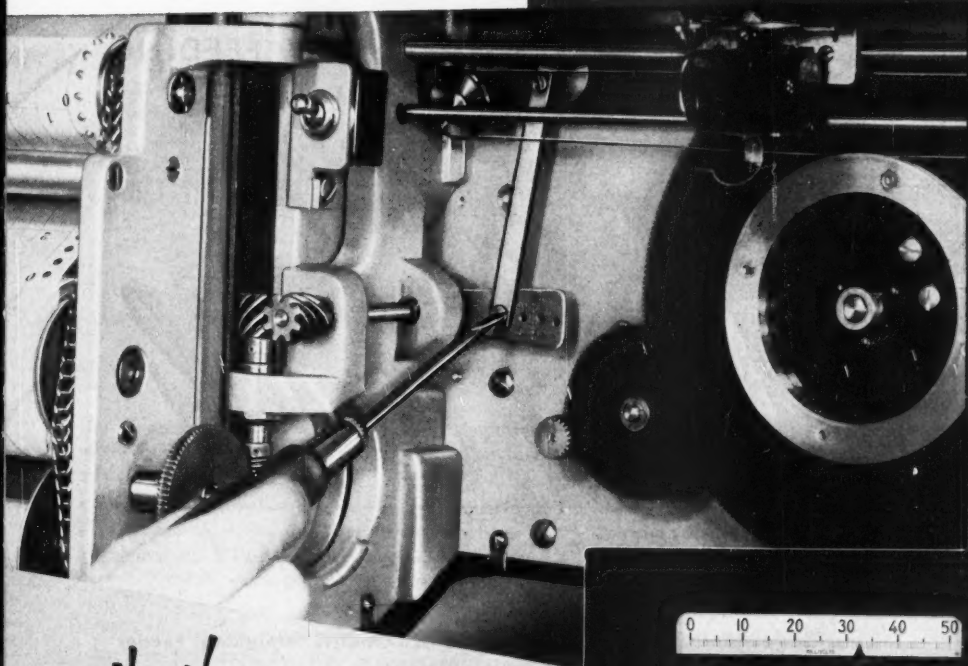
2:00 to 4:45 p.m.—Oil and Gas
Transportation Management and Eco-
nomic Symposium. Earl W. Unruh,
Sinclair Pipe Line Co., Independence,
Kans., chairman; aides, C. D. Hall,
Thornhill-Craver Co., Houston, Tex.,
and W. E. Weidler, Jr., Aluminum
Co. of America, Houston, Tex.

Review of Some of the Work of a
Typical API Pipe Line Sub-Commit-
tee on External Corrosion Protection
of Crude Oil Pipe Lines and Its Re-
lation to Similar Work in NACE, by
L. F. Scherer, Assistant General Man-
ager, Texas Pipe Line Co., Houston,
Tex.

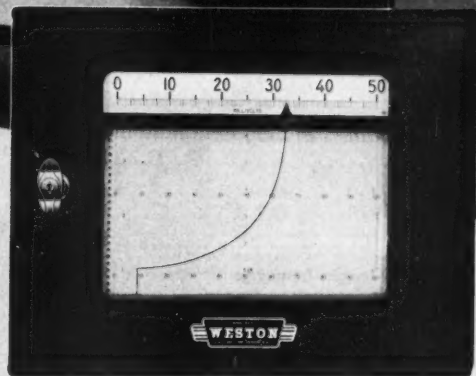
Review of Some of the Work of a
Typical API Sub-Committee on In-
ternal Corrosion Protection of Crude
Oil Pipe Lines, by R. A. Brannon,
Humble Pipe Line Co., Houston,
Texas.

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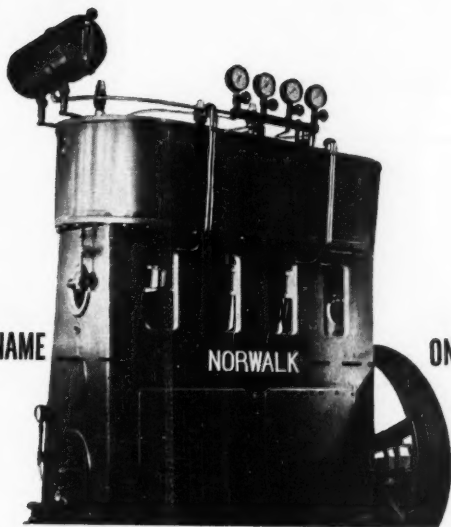


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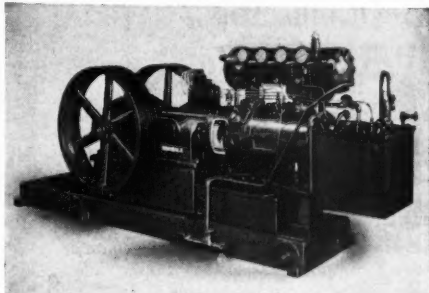
reversible ring plate valves, and generous cooling surfaces. Accessibility of all valves is one of its main features.

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YOUR BOSS, THE RESEARCH DIRECTOR He Has to Sell 5 "Publics"

You know him when he's wearing his technical hat. But have you ever thought about the human side of his job—the "publics" he—and you—have to keep happy.

Every industrial company of any importance in the country today is wrestling with the problem of improving its relations with the public.

A friendly community can make a research laboratory more productive; an unfriendly one can seriously undermine its morale.

Perhaps we can get some helpful light on the modern practice of public relations by taking a brief look at the way enlightened industrial companies now employ it. The growth of public relations has been rapid in recent years. And that growth is due to only one thing: it works. Good public relations practices pay off. And

public relations, now approaching the status of a profession, will continue to grow. For it has amply shown what it can accomplish.

There are many definitions of public relations, yet it has never been really defined. One of the best definitions I have ever heard was formulated by my friend Robert Updegraff, one of the pioneers of public relations, who said, "Public relations is simply the art of making more people want to do business with you." That includes not only wanting to buy from you, but also wanting to work for you, wanting to have you in the community, wanting to supply your needs, wanting to invest money in your enterprise.

The General Public . . .



. . . They "buy" your research when they prefer your product.

► **Many Publics**—The concept of public relations obviously implies the existence of a "public" with which there are to be relations. Actually, there are many "publics" and many of us belong to several different publics at once.

Consider the case of an employee who owns stock in his company, consumes some of its products, and is also a member of the school board in his community.

He is a man of many interests, some of them possibly conflicting. Yet so marvelously is the human mind constructed, these potential conflicts seldom appear as such to him. He usually keeps them in separate compartments in his mind, and considers them one at a time, depending on the role in which he finds himself cast at the moment.

► **It Takes Planning**—But dealing with so many publics at once requires organized planning on the part of the company. It cannot be all things to all men. In its every major act it must take into consideration the effect the act will have on various publics, and the extent to which that effect will help or hurt the company in its relationships and continued prosperity.

Public relations men discern seven principal publics that affect industrial companies in a major way. These are, first of all, the employees; then customers; stockholders and investors; communities; suppliers; the so-called

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growth and development groups, out of which come future employees, customers and investors; and finally the general public, which may include government.

► **First, Live Right**—To maintain right relations with any and all of these publics, there is one basic axiom that must never be forgotten. It is "Live right and tell about it."

Some have estimated that good public relations is 90 percent living right; 10 percent telling about it. Others have placed more emphasis on the telling. But the important thing is that the instruction contains two parts. The policies, actions, and decisions must be right—that is, be in the public interest. But right policies and actions alone, contrary to the now outmoded theory of the better mouse trap, are not enough.

You must also make sure that the affected public knows of your decision, action or policy, and knows it is right.

► **Second, Tell About It**—Experience, surveys and just plain common sense observation have shown over and over again that doing the right thing isn't enough. If the people don't know what you are doing, or if they have learned of it in such a way as to misinterpret it, your relations with them will suffer. To practice public relations effectively, "Live right, and tell about it."

Selection of the media for "telling about it" is important, too. However, the best medium for communications with another human being is by word of mouth. Discuss your matter with the other fellow and listen to his replies, and you will find how to inform and convince him. Next most useful medium is through public talks and discussion. The human voice is a powerful convincer, if truth and conviction lie behind it. Third most effective medium in most cases are pictures or graphic presentation.

Convincing communications depend not only on effective statement and the use of suitable media, but also, in most cases, on persistence.

► **A Case of Attrition**—The public is mighty busy. Others are competing for its attention, too. People naturally don't see everything the first time around so you must give them another chance.

There is a Russian proverb that is somewhat to the point, and worth remembering: "If you call a man a pig

100 times, on the 101st time he will reply 'oink!'"

Now, how shall we apply some of these lessons and observations to the public relations problems of the research department?

The busy research director is likely to want some concrete suggestions about how to go at the job; at least how to get started on the long road to becoming a public relations practitioner. Here is a short checklist that you might find useful, at least as a starting point for your own thinking:

- Cooperate with the company public relations department. Help the public relations men with their work to the best of your ability. Tell them what you are doing. Point out possible stories to them. After you have helped them with their work, you will find them willing and eager to help you with your own problems; with suggestions, advice and concrete assistance.

- Set up a regular schedule of personal visits to other company departments. Go often; not just when there's a problem to discuss, but between times, too. Communicate by listening to what the other fellow has on his mind. After you have listened to him, he will listen to you—and you'll know what to say.

- Have "open house" day, at the research department, for the company executives, and for the families of the staff. On these occasions, devise effective ways to explain and dramatize your work. Develop exhibits, talks, demonstrations. Call on the staff to help you; everybody will learn something new that way.

- If the company is so large that frequent personal visits by you to the other departments are impractical, consider publishing an informative but unpretentious intra-company "Research Department Newsletter," carrying news of research progress and accomplishments in laymen's terms.

- Develop an internal public relations program in the research department. If you don't already have them, start regular staff meetings, an employee publication, regular social get-togethers which members of the family can attend. Get acquainted with all the people who work with you and their families as well.

- Encourage staff participation in community affairs. Be a leader in this yourself; in such matters nothing succeeds like a good example.

- Encourage the staff to take the research story to the public, through popular talks, articles in newspapers and magazines, appearances on radio or television, and by other appropriate means. Support and encourage the staff in helping their national technical societies to carry on public relations work on behalf of science and scientists.—G. EDWARD PENDRAY

Fellow Employees . . .



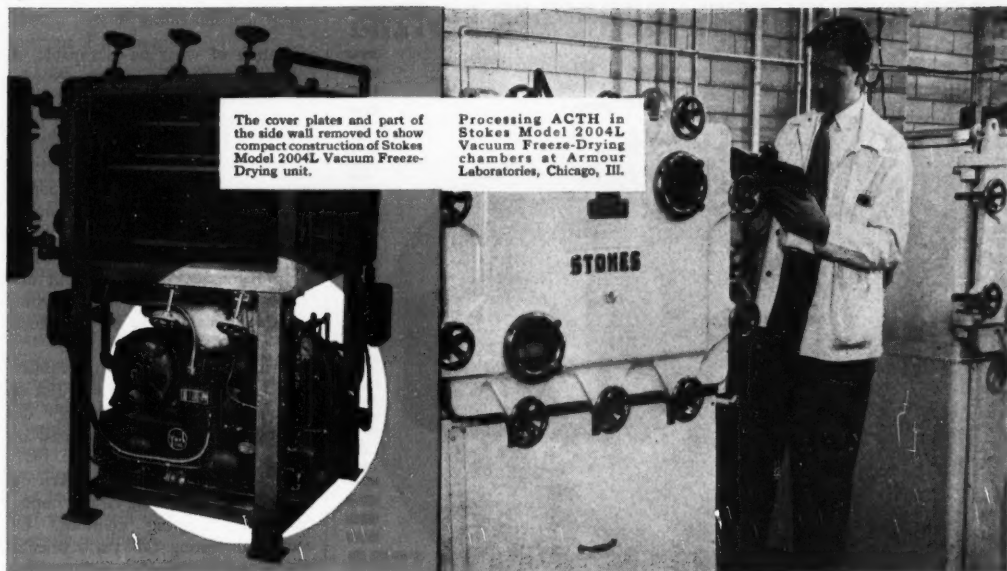
. . . The director gets men who can produce, keeps them doing it.

We have always considered that good relationships within the research department are maintained when the individuals feel that they are part of the over-all operating team, and whatever we can do to maintain this feeling is desirable. We often say that at least 80 percent of our budget is spent dealing with human problems and less than 20 percent goes toward the solving of our technical problems.

One of the very important elements of maintaining good relationships within the laboratories is that of having personnel who get along with each other. It is quite a job to screen out of the many, the few who fit our kind of organization.

The general corporation policy is that new salaried employees are on probation for the first six months. After this period they are considered permanent employees. In research, however, it is our general philosophy that the young technical graduate should have about a year to work into the organization and become integrated.

► **Time Is Best Test**—We have always felt that a few months of close association with a man gives a far better



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You AND Your Job, cont. . .

indication of what he is capable of doing than all the scholastic records, psychological tests, important as these are. We use all the records and tests available to select the best people we can, but for placement on a permanent basis, we rely primarily upon a man's performance during the probationary period.

So during the first three months of his probationary period, we put our young engineer through a fairly comprehensive orientation course which takes one-half day each week.

First, the young men are familiarized with the scope and activities of our entire laboratories through departmental presentations followed by questions and answer sessions.

In addition, the men are taken on inspection trips to visit various important manufacturing divisions. Of course, all during this year's orientation period, the young man is working on a schedule of rotating assignments. At the end of the year, we assign him, as nearly as possible, to the department of his choice. In other words, we try to provide quite a degree of freedom of action—even to the beginner.

► **No Clerking**—Another type of thing that we do to assist in improving our internal relations is to keep as much administrative red tape as we can away from our technical people. From a financial standpoint, we treat the laboratories on an over-all budget basis which very largely relieves our technical people of financial worries.

Through control of the number of people employed in the laboratories, amount of shop work the departments have available for their use and the amount of purchased materials that they may buy, we can maintain a very tight control of the budget.

A number of years ago, one of the difficulties we got into, before the present system went into effect, was that assigning funds for a project to a department was a sure and certain way of restricting the cooperative work between the departments. Each department treated its appropriation as though it were handling personal funds.

Now that we treat the funds as laboratory funds, and keep track of the distribution of costs by a very simple procedure, top management has accurate control of our expenditures and we can maintain our estimated budget

within plus or minus one-half of one percent if necessary.

How do we keep accounting records and personnel records away from our technical people? We do it by simply having certain departments responsible for actually gathering up necessary paper work and not asking the technical departments to do it. If the personnel department needs requisitions or other papers to employ somebody or change a salary, they simply ask the proper people in the technical department to sign the papers which are already filled out. A discussion among the administrative people will usually settle the method by which the paper work can be accomplished, with the least amount of work on the part of our technical people. Naturally, we cannot relieve the technical people of all red tape, but we can still keep it down to a reasonable minimum.

► **Encourage Initiative**—In a similar way, we initiate our projects. Our various department heads discuss prospective projects with top management. Sometimes the initiation of the project originates from the department. Sometimes projects develop from the contact our engineers and technical people have with the manufacturing divisions. Sometimes it comes in via top management.

There is no fixed way that we can establish as the procedure for originating a project. Prospective projects may be discussed for a year or two before any actual work is done. It may be necessary to do preliminary work to rough out the program. All of these things are initiated by conferences and are substantiated later with a charge number which gives official sanction to the project.

► **A Middle Ground**—The next important question is what do we do in connection with our technical records in the interest of maintaining good relationships and, at the same time, good records. Naturally, the engineers and scientists have to maintain adequate diaries, or log books, as some people call them. They have to write reports of tests and summarize over-all technical situations.

Over the years, we have been able to convince our technical people that unless they can keep their test data in good and reasonable form, and keep adequate diaries of what they have been doing, they will be in no position to give honest answers to the



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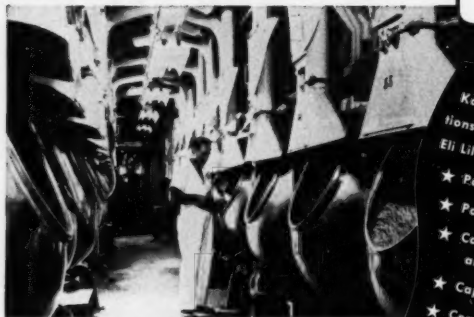
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YOU AND YOUR JOB, cont. . .

technical problems they are supposed to be solving.

So we require them to write reports when they have something to report. It is necessary for us to have rather elaborate formal technical reports to cover our projects adequately. These reports take from 30-90 days to complete from inception to final copy, ready for distribution. To make things a little easier for the engineers to report quickly investigations and short tests, we have an informal report known as the technical memorandum. Between these two types of reports, we are getting most of our work well reported and have not put a serious writing burden on the technical people.

As part of our consideration of good relations within the research department, there always arises the question: How far should we go in making reports available to the technical personnel?

► **No False Secrets**—We have found that if an engineer is of high enough quality to be in our organization, he is trustworthy enough to read any information we have in our laboratories. Consequently, we are very liberal with our reports. After the reports have been completed, they are turned over to the library for distribution and filing. All of our technical people have access to the library and can borrow our formal technical reports, with a very few exceptions, in the same way that one borrows books.

► **Broadcast Good Ideas**—By the same token, we are rather liberal with respect to publishing technical papers. We believe it is in the interest of developing good relations within the laboratories to do so. Publishing papers is often considered a good way for an engineer or scientist to develop his professional standing. And we are not interested in retarding the individual's development.

To summarize, we believe there are some major policies which assist in the maintaining of good relations within the laboratories.

- Provide facilities to relieve the technical personnel of as much red tape and paper work as possible.

- Arrange for the integration of the young men so that they will feel that they are part of the group.

- Be very liberal with the technical information developing within the or-

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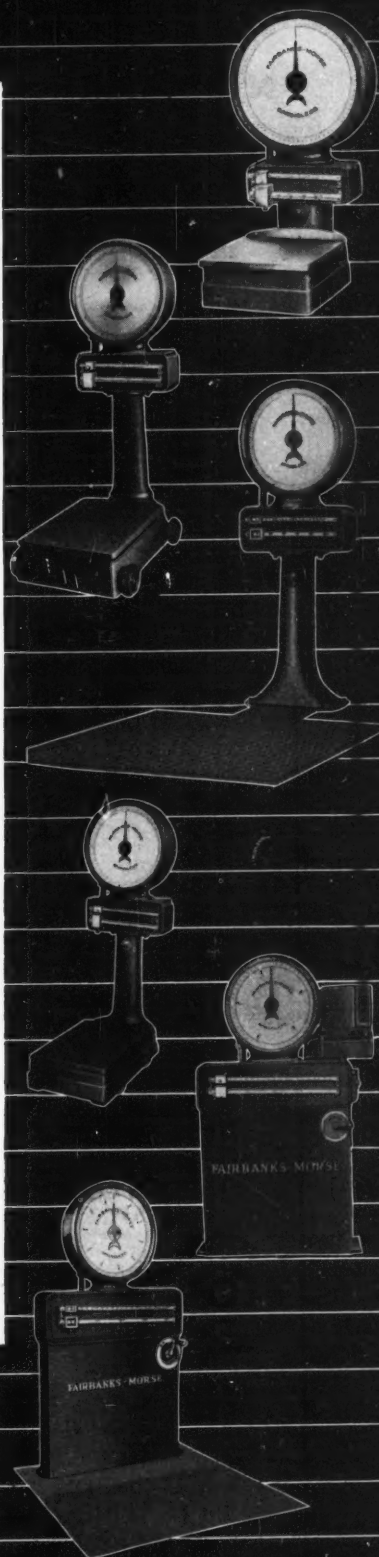
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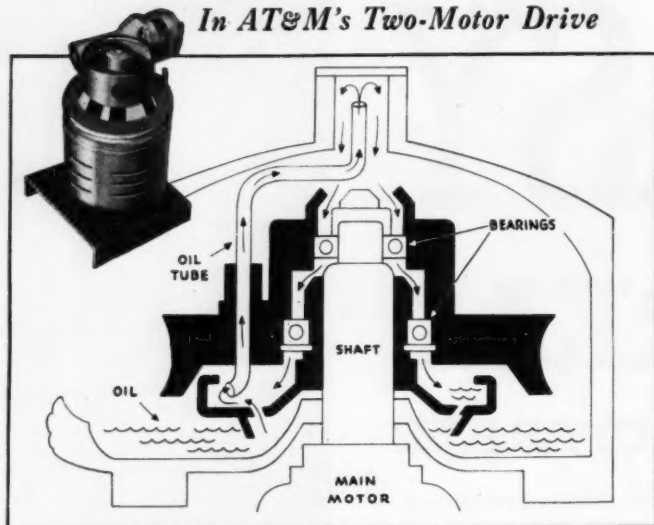
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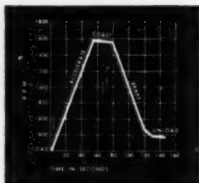


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YOU AND YOUR JOB, cont. . .

ganization to the members of the total organization.

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Fortunately, most directors in charge of research laboratories have a deep and inherent belief that scientists should make their works known for the general good of science. They know that free interchange of ideas is a powerful research catalyst that cannot be obtained any other way.

But, in addition to this basic truth, there are many other sound reasons why it is "good business" for the research laboratories to deliberately encourage their scientists to present papers, attend meetings, serve on committees, become officers, and in general, participate in the scientific society of their choice.

Scientific and engineering societies offer the most natural and efficient path for professional development because that is their key purpose in life.

► **Nurture Your Engineers**—Research and engineering is the heart of most industrial business. A company's research achievements and developments can be no better than its scientists and engineers. And over the years most companies have discovered that scientists and engineers who take advantage of the opportunities and contacts offered by their professional society, usually are the ones who emerge as technical leaders.

If this was true in the past it will be even more true in the future. Because of the increasing complexity of scientific and technical developments, research departments have more to gain from work in scientific societies today, than ever before.

The society activities of research departments in most companies have to be integrated with those of other departments. So with the foregoing as a backdrop, let's look at the over-all operation for technical societies at Westinghouse Corp.

To begin with, here are a few specific benefits we think the company—and the engineer—get:

- Technical meetings are the most powerful springboard the company has for launching new technical ideas convincingly on a national basis.

- Technical meetings provide a low cost way for engineers to get a lot of information quickly.

- Close personal contact with leading scientists and leading customer engineers is a good way to stimulate our people.

- Consistent participation in technical societies steadily increases the company's engineering reputation in the field.

- Technical societies are an effective means to help develop sound engineering codes and standards.

- Society work enables us to help guide engineering education.

- Good papers and good speakers before technical societies automatically create favorable publicity for the company.

Because such benefits have proved their worth for the past 20 years, Westinghouse has had a small department look after the company's activities with technical societies. It is part of the organization of the vice president of engineering, and thus performs a company-wide function.

A personal endorsement and sympathetic attitude toward association work by the Division Manager or Vice President of Research provides a sound company foundation on which to build. But because of their key position in the company and in technical society work, most of the job depends upon the Engineering Managers.

Essentially a staff operation the work is basically that of planning, coordinating, encouraging, and providing a centralized official channel for company clearance of all technical papers.—H. N. BLACKMON



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YOU AND YOUR JOB, cont. .

The Press . . .



... The reporter can be research man's missionary and ally.

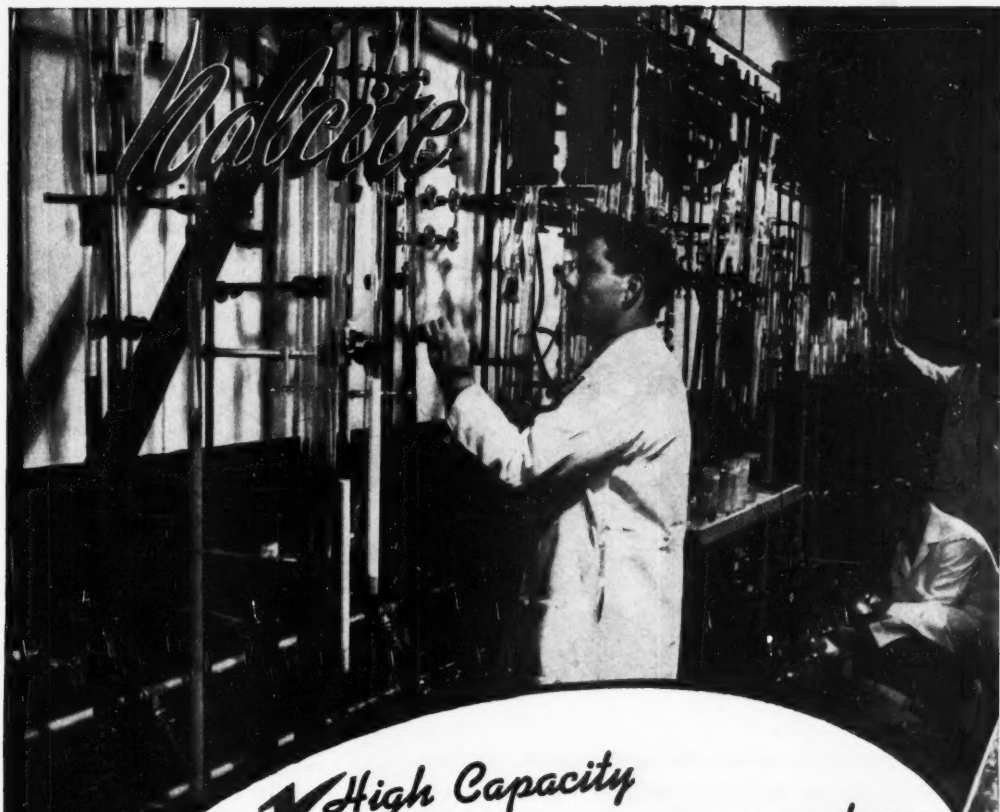
What is required to properly meet and utilize the press, to win the confidence of the public?

First, the researcher must develop the fullest confidence in the writers. He must understand that the writer is duty-bound to translate, often with words alone, cold formulas and chilly personalities into warm, interesting and informative pictures to his readers, and that he often must use the trick of over-simplification to attain his difficult goal. This important method of translation must be understood and agreed to by the scientist

► **Mutual Respect**—The researcher must be both articulate and patient with capable writers. He must remember that his mind has been trained to the exactness of formulas and minuteness of detail, while the writing mind paints with a broader and more colorful brush. Years of conscious endeavor have conditioned the mind of the researcher to leap over the A. B. C.'s of an experiment to the conclusion.

He must patiently go back in his approach to the mind of the reporter and trace for him the intricate steps for background so that the writer can determine the interest value to the public. What seems to be of little value to the scientist—because all of the other scientists know it automatically—may be of intense interest to the public, and the writer is the best judge of what the public wants to know. It's his living.

► **Watch the Pitfalls**—Above all, feel free to point out to the writer, the pitfalls in the development of his story,



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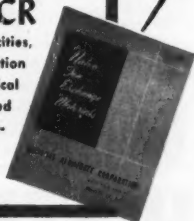
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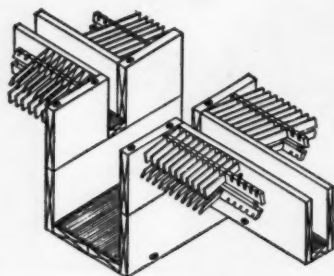
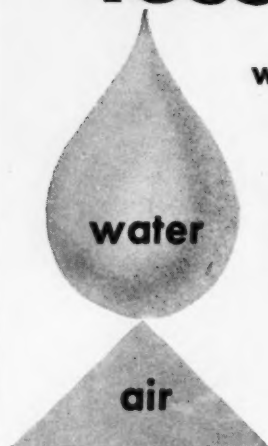
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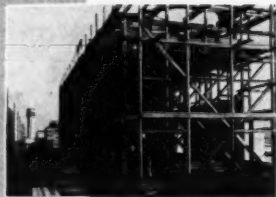
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YOU AND YOUR JOB, cont. . .

the shortcoming of your research. This will prevent painting pictures of false hope to the reader.—JOSEPH COPPS

Stockholders . . .



. . . They pay for the research, ought to know that it pays off.

I shall make some points which I think may be of guidance in the preparation of material to stockholders concerning research, and in capitalizing on this most effective attention-holder. The problem of applying these points, I quite freely admit, is not as difficult with Procter and Gamble as it may be with some companies.

► **Verisimilitude**—First of all, the material to stockholders must show a belief in research by the company. There, obviously, the man in the research end of the business has his primary problem cut out for him: the shareholders cannot be "sold" the idea of the company's belief in research unless the management really believes in it strongly.

Next, I would emphasize the fact that the word "research" must have definition in the mind of the shareholder. Here some careful thinking by the research man is indicated. In our division of stockholder information, we receive and examine a large mass of printed material which is sent from hundreds of corporations to their shareholders.

► **It's Mostly Bad**—If I were asked to tell you in what respect a large proportion of this material suffers, I would say that too often the technical facts concerning research and technical progress have not been sufficiently simplified and thinned down to clarity to make them understand-

able, acceptable and really interesting.

We stockholders, I submit, are nothing more than average readers. We are not technically trained—we are that illiterate. Constant and unceasing patience with the public's scientific illiteracy therefore is the only guarantee that the facts you know so well and believe in so absolutely can be clear to the public, including shareholders. Yet, I have seen material designed for the patient investor which only people in the particular business creating it could understand.

I have found myself, more than once, saying, "Is this company trying really to inform me, or is it just trying to impress me?" I submit that information, and not a dose of reverence, is what shareholders seek.

One way to make sure that such material concerning research today does not seem to be windy and "to claim the world" is to pay deference to the debt research owes to history. From time immemorial, people have liked to be taken behind the scenes—to know the real "inside" facts. To trace a marvelous product of today back to its simple beginning years ago adds interest and, if capably handled, adds believability. The experience of editors of all sorts of publications testifies that Horatio Alger's story-pattern—"Try and Trust"—"Strive and Succeed" is still in competent hands, a sure-fire interest-arouser.

If the shareholder feels that the research work is really serving, by bettering products so that the company will sell more of them, then the shareholder finds in the research a point of common objective between his desire for dividends and the research man's need for facilities.—W. G. WERNER

About Our Authors . . .

The foregoing are condensations of papers presented before the Industrial Research Institute in Cincinnati, Ohio, Nov. 7-9, 1951. G. Edward Pendray is senior partner, Pendray & Co., Industrial Public Relations, New York, N. Y. T. O. Richards is chief of the laboratory control section, General Motors Research Laboratories, Detroit, Mich. H. N. Blackmon is manager, Engineering Association Activities, Westinghouse Electric Co., East Pittsburgh, Pa. Joseph Copps is executive vice president and general manager, Steve Hannagan, Publicity, New York, N. Y. W. G. Werner is manager of public relations, Procter & Gamble Co., Cincinnati, Ohio.

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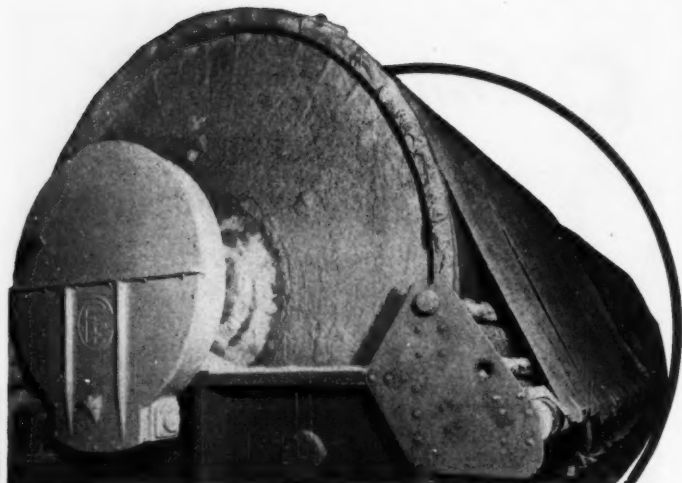
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MAN OF THE MONTH: Howard S. Bunn

Vision and enterprise of Bakelite's new president played a key part in creation of a market for his company's Vinylite plastics.

A 30-yr. veteran of the Union Carbide organization, Howard S. Bunn's first company assignment was to explore applications of Haynes Stellite alloy specialties to the chemical industry. He had just received his chemical engineering degree from Lehigh.

By 1929, executives of Carbide and Carbon Chemicals Co. (like Haynes Stellite Co., a division of Union Carbide) began to see impressive possibilities in the field of organic chemicals. They selected Mr. Bunn to manage

publicity and advertising work. Later he was made manager of the Pyrofax Division of the company. His efforts were directed toward expanding business in liquefied petroleum gas which Carbide had pioneered.

In the late 1930's, Carbide and Carbon had developed Vinylite plastics in a rigid form as a competitor to cellulose acetate. The sales volume for this form was relatively small. But when a plasticizer was added to the thermoplastic resins, Vinylite plastics in a variety of forms became available. Management saw that the future of Vinylite plastics lay in new applications rather than as a substitute for other plastics.

In 1938, Mr. Bunn was appointed manager of the plastics division of Carbide and Carbon with a dual responsibility: to build a sales organization with the vision and enterprising necessary to create a new market for these versatile plastics; to convince management of the importance and opportunities for growth of plastics in Union Carbide and Carbon's business.

Gathering ideas for the use of Vinylite plastics right and left, day after day was an important and fascinating part of his career at that point, says Mr. Bunn. The introduction of plastics into the upholstery and textile industries and for wire and cable insulation are a few of the results of the search for new applications for versatile Vinylite plastics.

In 1944, Mr. Bunn was made vice president, plastics division of Carbide and Carbon and vice president in charge of sales, thermoplastics department of Bakelite Co.

Since then he has also become: a director and vice president of Bakelite Co. (Canada) Ltd.; a director of Bakelite Ltd. (England); a director and vice president of Canadian Resins and Chemicals, Ltd.; a director of U. S. Testing Co.

His appointment as president of Bakelite was announced last May. Now he is supervising all of Union Carbide's plastics activities.

W. M. Flowers. President, Sinclair Research Laboratories, Inc. Has been executive vice president since May of last year. Joined Sinclair Refining Co. in the cracking division of their research and development department in 1928. New vice president and general manager of Sinclair Research Laboratories' research center in Harvey, Ill.: **E. J. Martin**, formerly assistant director of the company's lube research division. Joined the company in 1929.

Robert S. Whiteside. Vice president, Sterwin Chemicals Inc., New York. Has been an assistant director of

the company. With the company since 1941. Previously employed for 12 years as a chemist in the food field.

John F. Conlon. With the works engineering department of Carbide and Carbon Chemicals Co. at their Texas City, Tex., plant. Previously technical director of the Acumeter Laboratories, Inc., Newton Lower Falls, Mass.

James W. Hendry. Director of plastics research, Jackson and Church Co., Saginaw, Mich. To spend much of his time in foreign countries, conducting research and

studying development of automatic plastics molding machines. New manager of the company's plastics division: **Boyd W. Bullock.** Continues as assistant to the president.

Fred W. Fraley. Assistant administrator in charge of the chemical, rubber and forest bureau of NPA; has been deputy assistant administrator. On leave of absence as vice president in charge of sales of Diamond Alkali. Joined the company in 1928. Chemical engineering graduate of Rice Institute.

Howard L. Malakoff. Chairman, New York section, AIChE. Associated

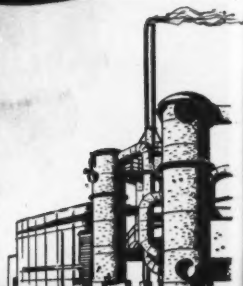


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NAMES IN THE NEWS, cont. . .

with Cities Service Research & Development Co. Vice chairman: **Frank B. White**, Foster Wheeler Corp.



E. B. Hershberg



D. Papa

E. B. Hershberg and Domenick Papa.

Co-directors of scientific research, Schering Corp., Bloomfield, N. J. Dr. Hershberg continues as director of Schering's natural products research department. Joined the company in 1945. Chemical engineering graduate of MIT; PhD. in organic chemistry from MIT. Dr. Papa retains his post as director of the synthetic medicinal research department. Veteran of 12 years in the research laboratories of the company.

Gordon Brown. Relected president of the Society of the Plastics Industry. Was a founder of SPI 15 years ago. A vice president of Bakelite Co.

Carl W. Borgmann. President of the University of Vermont. Has been dean of faculties at the University of Nebraska. Previous posts: member of the technical staff of Bell Telephone Laboratories, 1927 to 1931; assistant professor of chemical engineering at the University of North Carolina and head of the engineering department at the University of Colorado from 1943 to 1947.

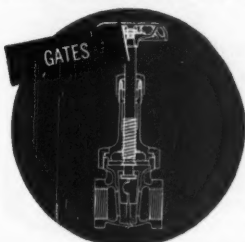
H. E. Tremain. Director of a newly created department of contract research at Wyandotte Chemicals Corp. Formerly assistant to the vice president of the research-development division. Will be in charge of all research activities under direct contract with governmental agencies.

Mercer G. Farrar. Recipient of the Distinguished Service Award of the Liquefied Petroleum Gas Assn.

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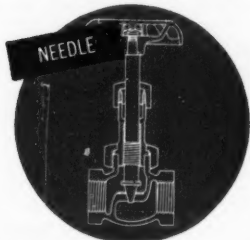
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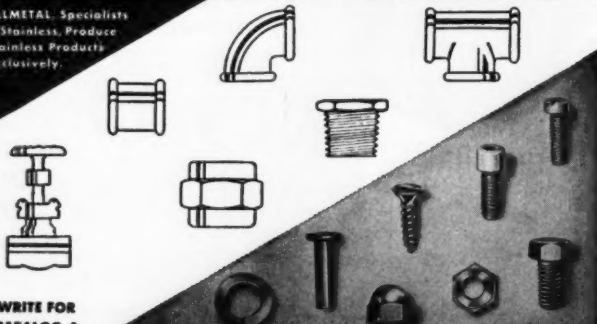
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NAMES IN THE NEWS, cont. . .

Chief engineer of the Pyrofax Gas Co., New York.

Weldon R. Burns. Senior project engineer, oil refinery division, Catalytic Construction Co. Since 1946, project engineer, Badger Process Division, Stone and Webster Engineering Corp. Before that, plant superintendent, Frontier Refining Co., Cheyenne, Wyo. and for Northwestern Refining Co., St. Paul, Minn.

R. S. Jane. President, Chemical Institute of Canada. Vice president, Shawinigan Chemicals Ltd., in charge of research and development.

P. M. Buhner. An executive vice president, National Carbon Co. Has been assistant general manager of National Carbon Co. and vice president and director of National Carbon Ltd. Entered the company's research laboratories in 1923. Chemistry graduate of Johns Hopkins.



P. M. Buhner



E. C. Medcalf

E. C. Medcalf. Head of the coal tar chemicals department, Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J. Posts at Calco since joining in 1933: research chemist, group leader, assistant chief chemist, production superintendent of the coal tar department, vice chairman of chemicals department technical committees.

John E. Swearingen. A director, Standard Oil (Indiana). Formerly, Standard's general manager of production. Joined the company in 1939 as a chemical engineer in the Whiting, Ind., research laboratories. Chemical engineering graduate of the University of South Carolina.

E. M. Kline. General manager, Huntington, W. Va., works of Interna-

tional Nickel Co. Has been assistant general manager of the works since 1947. Joined the company in 1923 as assistant chief chemist at Huntington. Studied chemistry at Penn State. His successor as assistant general manager of the works: G. K. Crosby, general superintendent at the Huntington works since 1947.

Myron Ceresa. Manager of electroplating projects, special products development division, Westinghouse Electric Corp. Has been a member of the electroplating projects section at East Pittsburgh, Pa., since 1947. Joined the company in 1937 as an engineer at the research laboratories.

George Barnhart. Retired as a research chemist at Du Pont's Jackson Laboratory after 34 years service. Devoted his early career to the development of sulphur colors. Devised a continuous laboratory dyeing machine for single threads and developed a novel procedure for chlorinating copper phthalocyanine. Studied chemical engineering at Bucknell.

Almo D. Squitero. Chief chemist, Hanson-Van Winkle-Munning Co., Matawan, N. J. Joined the company in 1950 as an electrochemist.

Harold L. Sheppard. Manager, plant operations, plastics division, Celanese Corp. of America. Formerly manager at the company's Belvidere, N. J., plant.

Marcel D. Labbee. Technical representative on enzymes for use in food and related products, Rohm & Haas Co., Philadelphia. Doctorate in food technology from the University of Massachusetts.

Bruce K. Brown. Re-elected president of Pan-Am Southern Corp. Had resigned as president of Pan-Am in November 1950 to become first deputy administrator for the Petroleum Administration for Defense, Washington, D. C. The National Petroleum Council Citation was awarded him for his work as deputy administrator.

George E. Holbrook. Director of the chemical division, NPA; has been assistant director since March. On

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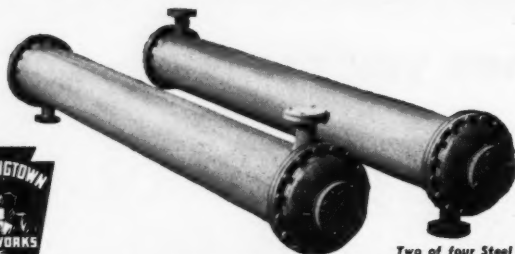
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NAMES IN THE NEWS, cont. . .

leave as assistant director of Du Pont's development department. Joined Du Pont as a research chemist at the Company's Jackson Laboratory in 1933. Doctorate in chemical engineering from the University of Michigan.

M. F. Ohman. Assistant general manager, Western Division, Dow Chemical Co. Has been the division's production manager for the past nine years. With the company since 1930. Started as a chemical engineer in the company's Midland, Mich., headquarters in 1930.

Stanley O. Winthrop. New member of the staff of the chemistry division of the Sterling-Winthrop Research Institute. Doctorate from the University of Texas, Austin, Tex.

Harold E. Clayton. Manager of the Davison Chemical Corp.'s plant at Perry, Iowa. With the company for 15 years.



H. E. Clayton



R. E. Hulse

Robert E. Hulse. Vice president, National Distillers Products Corp. Vice president of its partially-owned subsidiary, National Petro-Chemicals Corp., since its inception in 1951. Became associated with National Distillers in 1949 as director of research and development. Previously with Du Pont for 19 years in various research and production capacities including that of plants manager. Doctorate from Cornell.

Cary R. Wagner. From senior vice president to chairman of the executive committee, General Aniline & Film Corp. Became a director of General Aniline in 1947.

Gareld S. Hotchkiss. Chief chemist and production manager of the New Orleans Paint and Color Co.'s manufacturing plant in New Orleans.

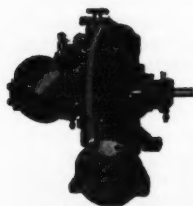
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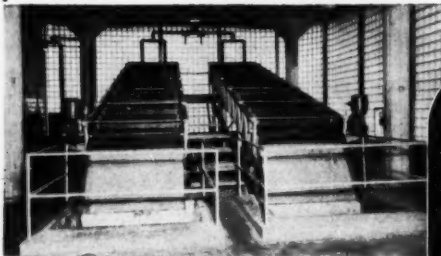
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NAMES IN THE NEWS, cont. . .

Edgar L. Demarest. West Coast district manager for the Bufllovak Equipment Division, Blaw-Knox Co. Has been sales engineer for the past four years in the New York District Sales Office.

Herbert E. Hirschland. Director of research, Metal & Thermit Corp., New York. Has been assistant sales manager, chemical sales division. With the company since 1941 when he joined its research laboratory staff in Rahway, N. J. Studied chemical engineering at Dartmouth and MIT.



I. C. Clare



M. Hoffman

Irwin C. Clare and Mark Hoffman. Assistant directors of research, C. K. Williams & Co., Easton, Pa. Mr. Clare: for the past three years, chief of the paint section of the company's research laboratory; for 15 years previous, with Hercules Powder Co.—part of the time as head of the evaluation division of the experiment station. Studied chemistry at Tufts and the University of Maryland. Mr. Hoffman: since 1933 with the company's production department most recently as assistant plant superintendent and chief plant chemist. Chemical engineering graduate of Lafayette College.

Francis J. Curtis. President of the Society of Chemical Industry. Vice president and director of Monsanto Chemical Co. Lately ended a year's leave of absence during which he served as assistant administrator in the office of NPA in Washington in charge of its chemical, rubber and forest products bureau.

Richard K. Flitcraft. Assistant research director, Monsanto's Merrimac Division, Everett, Mass. Company history: joined in 1942 as a control chemist; group leader in the development department of the W. G.

Krummrich plant, Monsanto, Ill.; supervisor in the manufacturing department; plant development superintendent. Studied chemistry at Rutgers.

C. J. Francisco. Manager in charge of technical activities, Harvey, Ill., research center, Sinclair Research Laboratories. Joined the company in 1941 to work with the wartime research center of the company's development department.

W. A. Koehler. From acting director to director, engineering experiment station, West Virginia University. Professor and head of the university's department of chemical engineering.

Paul L. Howard. Technical director, Yardney Electric Corp. Has been with the electrochemistry section of the National Bureau of Standards, Washington, D. C.

John M. Woods. Assistant professor of chemical engineering, Purdue. Has been assistant professor chemical engineering at the University of Rhode Island for the past two years.

William H. Ward. Chairman of the board, Manufacturing Chemists' Assn.; vice president of E. I. du Pont de Nemours & Co. He succeeds **Charles S. Munson**, chairman of the board of Air Reduction Co., who was elected president of the association. **H. W. Fisher**, Standard Oil (N. J.), was named vice chairman. New vice presidents of the association: **John E. McKeen**, president of Chas. Pfizer & Co.; **W. S. Richardson**, vice president of B. F. Goodrich Co.



W. H. Ward



A. Marzocchi

Alfred Marzocchi. Manager, textile chemistry section, Fiberglas textile products laboratory of Owens-Corning Fiberglas Corp. at Ashton, R. I. Previous positions: quality



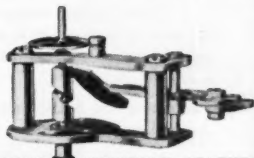
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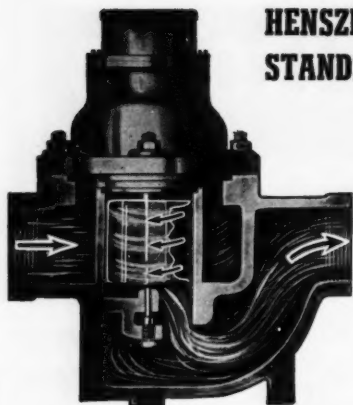


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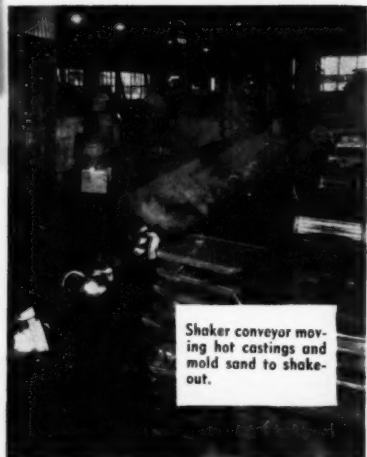
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NAMES IN THE NEWS, cont. . .

control supervisor at the Ashton and Huntingdon, Pa., plants of the Fiberglas Corp.; most recently, manager of organic sales with Cowles Chemistry Co. Doctorate in organic chemistry from Syracuse University.

H. Rupert Hanmer. Recipient of the Virginia section, ACS annual Distinguished Service Award given for outstanding contribution to the professional standing of chemists. Director of research, American Tobacco Co. Joined the company in 1921 as a research chemist; elevated to his present post in 1932. Chemistry graduate of the University of Vermont.

Harry B. McClure. Honorary chairman of the American section, Society of Chemical Industry, for 1952-1953. Vice president, Carbide & Carbon Chemicals Co. since 1944. Joined the company in 1928. Studied chemical engineering at the University of Pennsylvania.

Robert J. Aitchison. Chairman of the board, Fansteel Metallurgical Corp. and its subsidiary, Vascoloy-Ramet Corp. New president of Fansteel: **Frank H. Driggs.** Came to the company in 1934 as director of research; vice president in charge of technical development, 1938; executive vice president, 1952. New director of the technical division: **R. Winchester,** a member of the company's technical staff since 1937.

Willis Henry Beltz. Director of the Naval Research Laboratory, Office of Naval Research. Has been assistant chief of the bureau of ships for electronics. In the regular Navy since 1946. Previous employers: GE and RCA. Graduate of the University of Kansas.

Richard H. Starrett. From development engineer to chief engineer of the Elyria, Ohio, division of the Pfaunder Co. Previous to joining the company in 1948, he spent several years as a consulting engineer in the rubber and plastics field.

Davis W. Chaney. Senior group leader in charge of the research section at the Decatur, Ala., plant of Chem-

hot liquids

corrosives

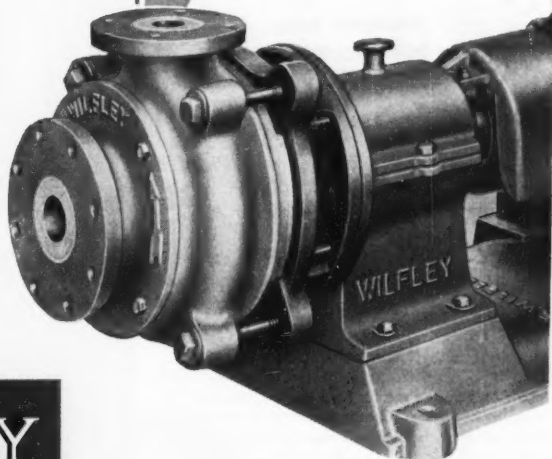
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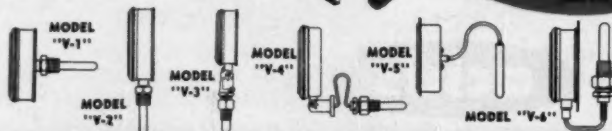
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NAMES IN THE NEWS, cont. . .

strand Corp. Transferred from the company's Marcus Hook, Pa., plant where he supervised research on acrylic textile fiber at Chemstrand's pilot plant. Joined Chemstrand in 1951 following nine years of service as a research chemist with American Viscose Corp. Doctorate from the University of Pennsylvania.

John M. Jernigan. Technical service director, Reichhold Chemicals' southern division in Tuscaloosa, Ala. Has been a chemist in the division's laboratories.

D. H. Lewis. A vice president, Shell Pipe Line Corp. Joined the company in 1927. Has directed such major projects as the East Texas Gathering System, Ozark Pipe Line System, Bayou Pipe Line System.

Allen V. Astin. From acting director to director, National Bureau of Standards. Previously, associate director in charge of both the bureau's ordnance development missile, electricity and electronics division and the office of basic instrumentation. With the bureau since 1932.

Anton de S. Brasunas. Assistant professor of metallurgical engineering, department of chemical engineering, University of Tennessee. Has been a research metallurgist with the Oak Ridge National Laboratory. New assistant professor of chemical engineering and bacteriology: **Robert Kieber**, previously with the Camp Detrick laboratories of the U. S. Army.

L. W. Munchmeyer. President of the Armed Forces Chemical Assn. Assistant general manager, Ansco Division, General Aniline and Dye Corp.

T. R. Ragland, Jr. Manager of the new gas procurement department of Carbide and Carbon Chemicals Co. Has been superintendent of the company's South Charleston, W. Va., plant since 1945. Joined the company at South Charleston in 1928. Chemistry graduate of VMI.

C. J. Strosacker. Relinquishes some of his duties as vice president and production manager, Dow Chemi-

cal Co., to devote full time to saran fabrication plants and research laboratories. Became the company's superintendent of production in 1909; production manager, 1915; member of the board of directors, 1931; a vice president in 1941. New manager of the newly-formed plastics production department: **William H. Schuette**. Manager of saran production: **Max Key**. Manager of polystyrene production: **Earl L. Collins**; manager of cellulose products production: **Albert T. Maasberg**.

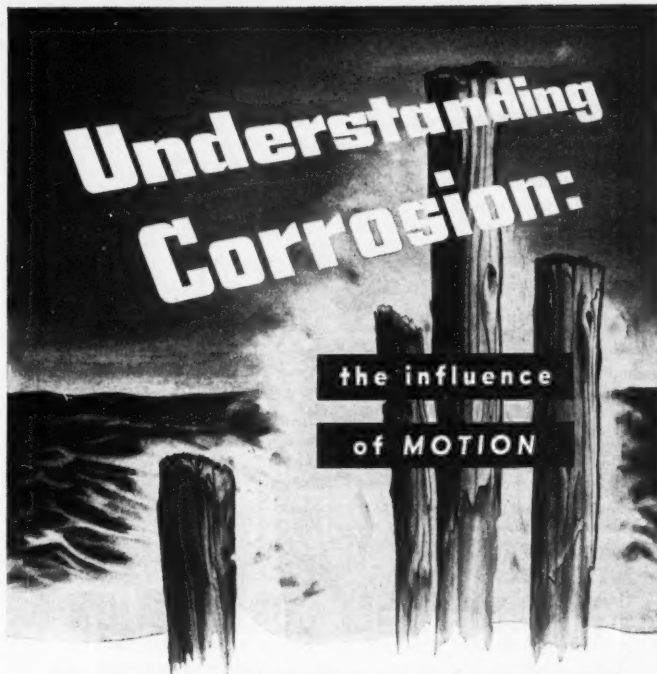
Robert E. Reinker. Technical adviser to the president of Asahi-Dow Ltd., recently formed associate of Dow Chemical International, Ltd. and the Asahi Chemical Industry Co., Ltd. of Japan. Has been superintendent of Dow's saran polymer plant at Midland for the past two years. With the company since 1942. Graduate of Case Institute of Technology.

Harley M. Ross. From superintendent of Carbide and Carbon's Texas City plant to assistant works manager for the company.

Adalbert Herman. Vice president of Joseph E. Seagram & Sons in charge of production at all affiliated company plants. Associated with Seagram's since 1929 in executive production capacities both in Canada and the United States.

Harold L. Maxwell. New president, ASTM. Supervisor of mechanical engineering consultants, Du Pont. New vice president: **Norman L. Mochel**, manager, metallurgical engineering, Westinghouse Electric Corp. New board members: **George R. Gohn**, supervisor creep and fatigue laboratories, Bell Telephone Laboratories; **William H. Lutz**, technical director, Pratt & Lambert, Buffalo, N. Y.; **Howard K. Nason**, research director, organic chemicals division, Monsanto Chemical Co.; **Adolph O. Schaefer**, vice president in charge of engineering and manufacturing, Midvale Co.; **Myron A. Swayze**, director, Lone Star Cement Corp., New York.

Harold M. Madsen. Administrative assistant to the general manager of manufacturing, Standard Oil Co.



Because increasing the degree of motion of a corroding solution brings more oxygen to the surface of the metal with which it is in contact, such increase has a decided influence on the rate of corrosion. In liquid that may appear quiet, convection currents are nonetheless at work slowly distributing dissolved oxygen throughout the solution. When velocity agitates the liquid-air interface, unsaturated liquid is brought to the surface layer and the oxygen-solution rate rapidly stepped up. At the same time the liquid film on the surface of the metal is thinned so that this increased amount of dissolved oxygen diffuses more readily. Thus the combined effect of more dissolved oxygen conveyed more rapidly to the metal is a marked acceleration of corrosion.

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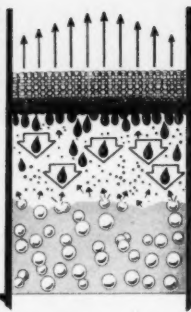
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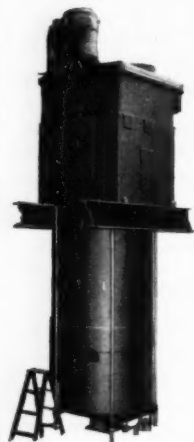
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(Indiana). Formerly supervisor in the training section of the industrial relations division at the company's Whiting, Ind., refinery. Joined Standard in 1928 at its Whiting refinery where he has since worked in the engineering, projects and industrial relations division.

W. R. Riggs. Manager in charge of general services, Sinclair Research Laboratories, Harvey, Ill. Has been director of the company's pilot plant division. Joined the Sinclair organization in 1932. Chemical engineering graduate of Missouri School of Mines.

Crawford H. Greenewalt. To receive the Chemical Industry Medal for 1952 awarded by the American section of the Society of Chemical Industry. President, chairman of the executive committee and a member of the finance committee of Du Pont since January 1948. Joined the Philadelphia Works of the company in 1922 as a chemist. Chemical engineering graduate of MIT.

Jose B. Calva. Recipient of the Leo Altenberg award presented by the Technical Assn. of the Fur Industry. Dr. Calva is the inventor of a process for making imitation fine furs from sheepskins by permanently straightening wool fibers chemically.

OBITUARIES

Quinton T. Dickinson, manager of the coal tar chemicals department, Calco Chemical division, American Cyanamid, died at Bound Brook, N. J., June 1. He had been with Calco since 1928.

C. Welland Crowell, vice president of Rochester Cernicide Co., died in Rochester, N. Y., June 1.

Louvian G. Simons, paper mill engineer for Chas. T. Main, Inc., Boston, died on June 10. He had been with the company since 1945.

W. B. Dexter, since 1945 superintendent of the research laboratories of the National Carbon Division of the Union Carbide & Carbon Corp., died July 13.



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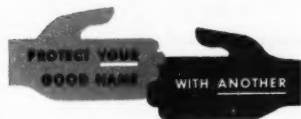
... to your direct current motor problems, look to your nearby Fairbanks-Morse Electric Motor Specialist.

He is technically qualified to help you select the equipment exactly suited to your D.C. needs.

Whether you are interested in a D.C. or A.C. motor ... one or a thousand—one type and size, or a variety of types and sizes ... you'll find that motors carrying

the Fairbanks-Morse Seal are designed and built to your most rigid requirements.

When you look for electric motors—for standard or unusual applications—*always* look for the Fairbanks-Morse Seal. For over 120 years it has stood for the finest in manufacturing integrity to *all* industry. Fairbanks, Morse & Co., Chicago 5, Illinois.



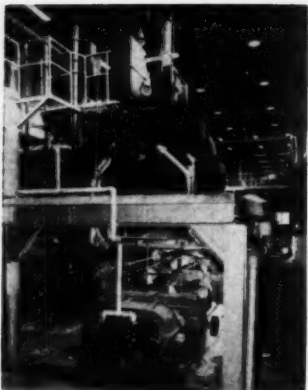
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INDUSTRIAL NOTES

NEW FACILITIES



Quaker Rubber Corp., Philadelphia—

Two new Banbury mixers and compounding mills extending two stories high, part of a new \$750,000 compounding and mixing building.

National Distillers Products Corp.—

Business and assets of the Algonquin Chemical Co., manufacturers of chlorine, caustic soda and sulphuric acid with plants at Huntsville, Ala., Dubuque, Iowa, Lawrence, Kans.

Lion Oil Co., El Dorado, Ark.—Plant

to produce anhydrous ammonia and prilled ammonium nitrate at Luling, La. It will be completed early in 1954.

Hercules Powder Co.—A \$400,000 bi-

ological laboratory to be completed in Wilmington, Del., in mid-1953.

Galvanic Products Corp., New York—

A plant, already in operation in Valley Stream, N. Y., to make selenium rectifiers, complete rectifier equipment and allied electronic components.

American Potash & Chemical Corp.—

A \$300,000 research laboratory in Whittier, Calif. Scheduled for 1953 completion, the laboratory will supplement present research facilities at Trona, Calif.

R. S. Aries & Associates, N. Y.—A

regional office in San Antonio, Tex.,

directed by Alden H. Waitt, company vice president.

Continental Oil Co., Ponca City,

Okla.—A synthetic detergent plant in Chicago which it has purchased from the Stepan Chemical Co.

Colton Chemical Co.—A new plant in

Cleveland to manufacture polyvinyl alcohol.

Koppers Co.—A plant at Fontana,

Calif., to produce tar-base enamel pipeline coatings and roofing pitches.

Davison Chemical Co.—A triple super-

phosphate plant at Ridgewood Fla. This is the first such plant for the company although it has been a major producer of phosphate rock and normal superphosphate. Completion date is expected to be October, 1953.

Atlas Powder Co.—A new West Coast

office located in San Francisco to handle its industrial chemical products.

Ethyl Corp.—Additions to its Baton

Rouge, La., facilities to accommodate large-scale production of the insecticide, lindane, and benzene hexachloride from which lindane is derived. Both should be in operation by early next year.

National Alfalfa Dehydrating & Mill-

ing Co.—A \$1 million chlorophyll plant at Lamar, Colo., adjacent to the firm's present facilities. The addition will provide for processing crude extract for finished chlorophyll, refine chlorophyll from alfalfa meal by solvent extraction, adding 4,000 lb. of chlorophyll per month to production capacity.

Quaker Rubber Corp.—A branch ware-

house and sales office in Dallas, Tex., for its rubber conveyor and transmission belting, hose, packing and molded rubber products.

Rayonier, Inc.—A \$25 million pulp

mill near Jessup, Ga. It will add 87,000 tons of capacity to the company's annual production.

Tennessee Eastman Co.—A sales service laboratory at Kingsport including both testing and analytical sections. The company has also opened a new office in Houston for the sale of Tenite.

Texas City Refining, Inc.—The world's

largest Houriflow unit at its Texas City refinery. To be completed by year's end, the unit will have a design capacity of 19,000 bbl. per day.

A. E. Staley Mfg. Co., Decatur, Ill.—

Branch sales offices at Chicago, St. Louis and Kansas City, Mo.

Mathieson Chemical Corp., Balti-

more—Fertilizer facilities and buildings of Temple Cotton Oil Co. which are adjacent to Mathieson present fertilizer plant at North Little Rock.

Midwest Piping and Supply Co., St.

Louis—An addition to its welding fittings manufacturing plant which doubles its pressing and welding capacity.



Barrett Division, Allied Chemical &

Dye Corp.—Processing and testing area, part of a new laboratory in Edgewater, N. J., specially designed to develop and test materials and processes used in the manufacture of plastics, rubber products, paints and varnishes, paper, laminates, insulating materials.

NEW REPRESENTATIVES

Monsanto Chemical Co. has appointed A. C. Mueller Co., Cleveland, as exclusive sales agent for its lampblack in northern Ohio.

Laminex Corp., Fall River, Mass., has appointed Process Associates of West Englewood, N. J., as selling

**CRUSH
POWER-SHOVEL-LOADED MINERALS
TO 8 OR 10 MESH
IN ONE OPERATION!**



WILLIAMS SUPER SLUGGER

**... CUT CRUSHING COSTS
AS MUCH AS 50%!
... REDUCE INVESTMENT
AS MUCH AS 75%!**

A Hammer Mill as powerful, big and rugged as they come! Takes minerals as large as a 2½ yard dipper can handle and reduces them to ¾" or smaller—even down to 8 mesh—in a single operation! Bauxite, phosphate and asbestos rock, shale or other materials are accurately crushed to size with equal economy and even greater speed. Capacities range up to 550 tons per hour.

One Super-Slugger will actually do the work of an ordinary primary crusher plus several secondary reduction machines—do it faster and better—and far more economically! All expense of extra foundations, housing, conveyors or elevators, and drives, is entirely eliminated. Power requirements are much less. Exceptionally large shafts, extra heavy manganese steel liners and breaker plates, shock and wear-resistant reinforcing—all reduce upkeep and downtime, depreciation and wear to absolute minimums.

If you're in business for PROFIT, you can't afford NOT to know what the Super-Slugger can do for you!

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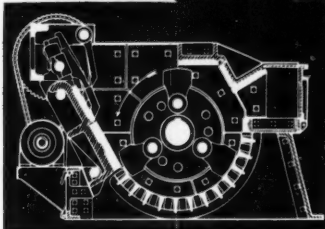
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HAMMER MILLS in many types and sizes for any requirement... ROLLER and IMPACT MILLS for fine grinding to any mesh, even to micron sizes... HELIX-SEAL HAMMER MILLS for dust-free grinding and for wet, sticky, greasy materials... DRYER MILLS for grinding wet materials down to 400 mesh... AIR SEPARATORS... VIBRATING SCREENS... COMPLETE PLANTS for crushing and grinding.



Cross section of Super-Slugger equipped with "Pusher Feeder" non-clog device for maximum feeding of sticky or wet materials through crusher.

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OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD

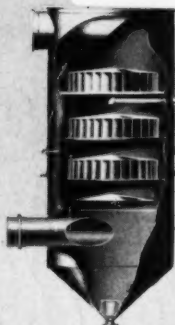
CHEMICAL ENGINEERING—August 1952

307

DUST
FUMES
VAPORS
OR GASES

EFFICIENTLY CONTROLLED BY MULTI-WASH

MULTIPLIES WASHING
FOR TOP EFFICIENCY



Only Schneible Multi-Wash collectors can give you the benefit of extra washing action that assures maximum removal of all contaminating material.

You can be sure of top efficiency with a minimum of up-keep because the Multi-Wash principle employs no moving parts or nozzles that can wear or clog.

Multi-Wash collectors installed 15 years ago are still operating which proves the Schneible principle gives lasting performance.

Write for bulletin 551 or contact your local Schneible representative.

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PRODUCTS:

Multi-Wash Collectors • Uni-Flu Standard Hoods
• Uni-Flu Compensating Hoods • Uni-Flu Fractionating Hoods • Water Curtain Cupole Collectors
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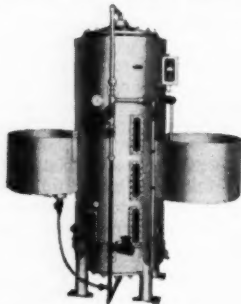
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For Process, Boiler Feed & Other Needs

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*COSTS LESS, OPERATES
FOR ONLY PENNIES

Whether your requirements for dependable, high-purity water are 10 or 10,000 gph, there is a Penfield "Planned Purity" System waiting to make important savings for you in both original equipment and operating costs. Write today for new catalog showing all Penfield water-treating equipment.

Operating on the most efficient deionizing technique known (intimately mixed cation and anion resins in a single unit tank), raw water passes through a Penfield Mono-Bed Demineralizer only once, yet comes out with resistances reported as high as 20,000,000 ohms. No heat or steam power is ever required, and regeneration of the resins is accomplished by simple gravity and displacement methods.

RUBBER-LINED, SARAN-
LINED & NICKEL TANKS

Specialty fabricated to suit your individual requirements by Penfield's Tank Fabricating and Lining Division. Write today for complete details.

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FILTERS
SOFTENERS

Penfield "Planned Purity" PAYS!

DEGASIFIERS
DEMINERALIZERS

INDUSTRIAL NOTES, cont. . .

agent for its line of Fiberglas-reinforced plastic resin trucks, tanks and tubs.

Dow Chemical Co., Midland, Mich., has appointed Parham Industries, Inc., Detroit, as a Michigan area distributor for Styrofoam, its light weight plastic foam of multicellular structure.

Edward Valves, Inc., East Chicago, Ind., has appointed Reed & King, Inc., Minneapolis, as its sales representative for Minnesota, North Dakota, South Dakota and northwestern Wisconsin.

NEW COMPANIES

Kewanee-Ross Corp., a merger of Kewanee Boiler Corp. and Ross Heater & Mfg. Co., to provide a substantially broader scope of operations than was possible formerly, enabling a wider range of related products and services.

Documentation Inc., Washington, D. C., a new service in the publication, analysis, organization and communication of specialized information. Its founder: Mortimer Taube, formerly deputy chief, technical information service, AEC.

NEW NAMES

Portersville Stainless Products Corp., Portersville, Pa., manufacturer of stainless steel liquid and bulk transportation tanks, has changed its name to Portersville Stainless Equipment Corp.

NEW SERVICES

Computer Corp. of America, New York, has inaugurated a service which furnishes solutions to complex problems in dynamics for industrial organizations, government bureaus and researchers. Problems will be accepted for analysis and solution whether the use of a computer is required or not.

NEW LINES

Colton Chemical Co., Cleveland—A urea formaldehyde plastic foam through the purchase of U. S. Rubber Co.'s Plotofoam Insulation Division. —End

Laborer.

1952 MODEL



No matter how good a man may be with a hand shovel and wheelbarrow, his production is many times greater as a "PAY-LOADER" pilot. What's more — both he and his boss are happier because they both make more money.

In hundreds of fertilizer and chemical plants "PAYLOADERS" have taken over unpleasant, laborious material-moving chores — saving time, cutting costs and increasing production. They scoop up, carry, dump, spread and stockpile all kinds of materials such as fertilizer, chemicals, coal, coke and ashes . . . lift, push . . . spot and unload box cars and do many other cost-cutting jobs

. . . release manpower for more productive work.

Every "PAYLOADER" is a complete Hough-built tractor-shovel designed specifically for tractor-shovel work, with multiple reverse speeds, large pneumatic tires and other features that insure fast, low-cost performance over floors or unpaved ground, up and down ramps, through congested areas. The "PAY-LOADER" is sold by a world-wide Distributor organization with complete service facilities and seven sizes are available from 12 cu. ft. to 1½ cu. yd. bucket capacity. The Frank G. Hough Co., 754 Sunnyside Ave., Libertyville, Illinois.



JOB STUDIES

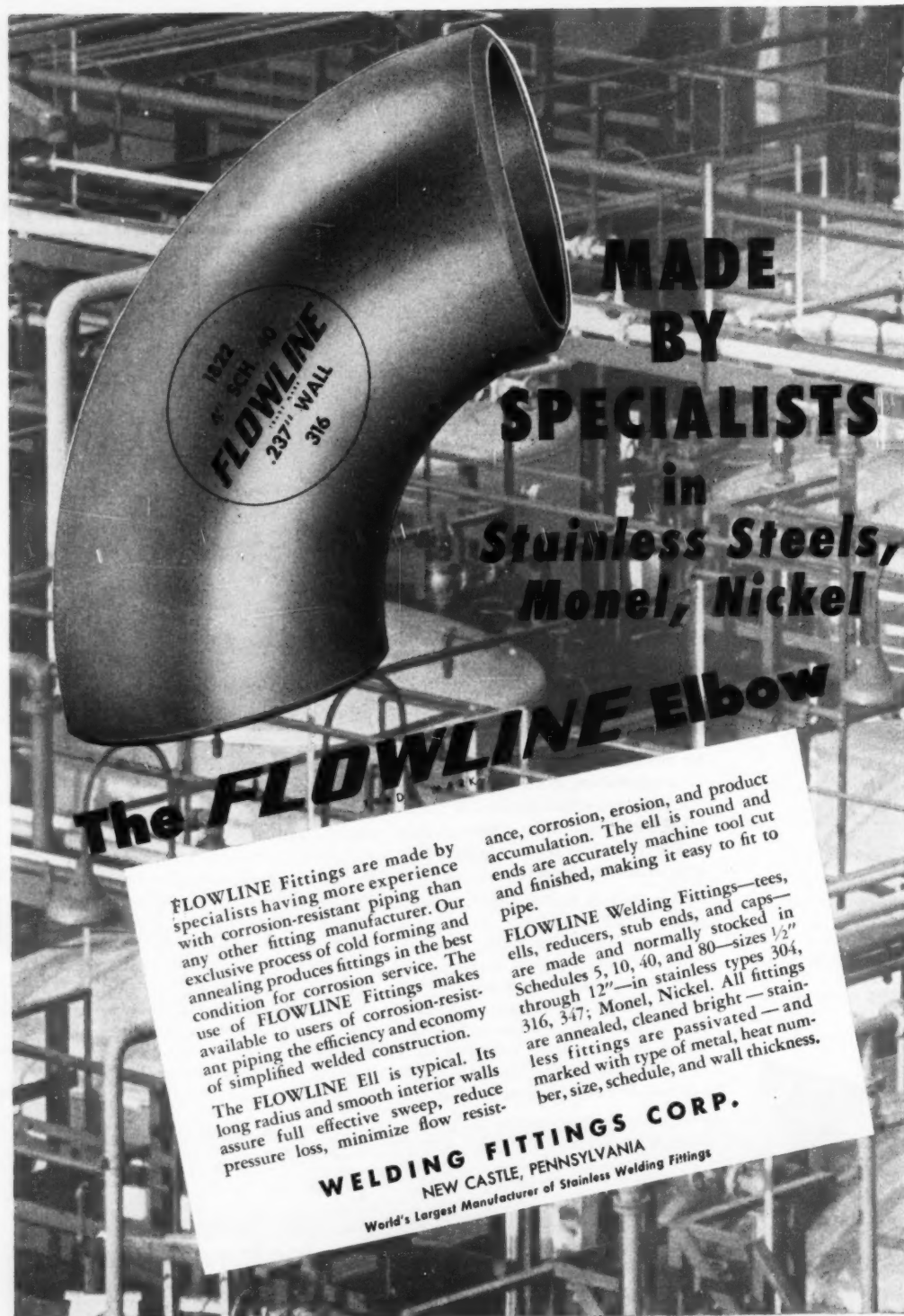
are available without cost or obligation. Each one is a detailed, authorized word-and-pic-

ture report of "PAYLOADER" performance in a specific plant. A request on your letterhead is all that's necessary.



PAYLOADER





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BY
SPECIALISTS**

**in
Stainless Steels,
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The FLOWLINE Elbow

FLOWLINE Fittings are made by specialists having more experience with corrosion-resistant piping than any other fitting manufacturer. Our exclusive process of cold forming and annealing produces fittings in the best condition for corrosion service. The use of FLOWLINE Fittings makes available to users of corrosion-resistant piping the efficiency and economy of simplified welded construction.

The FLOWLINE Ell is typical. Its long radius and smooth interior walls assure full effective sweep, reduce pressure loss, minimize flow resist-

ance, corrosion, erosion, and product accumulation. The ell is round and ends are accurately machine tool cut and finished, making it easy to fit to pipe.

FLOWLINE Welding Fittings—tees, elbows, reducers, stub ends, and caps—are made and normally stocked in Schedules 5, 10, 40, and 80—sizes 1/2" through 12"—in stainless types 304, 316, 347; Monel, Nickel. All fittings are annealed, cleaned bright—and stainless fittings are passivated—and marked with type of metal, heat number, size, schedule, and wall thickness.

WELDING FITTINGS CORP.
NEW CASTLE, PENNSYLVANIA

World's Largest Manufacturer of Stainless Welding Fittings

NUCLEAR POWER

... Isotopes Necessary

"The peacetime industrial utilization of nuclear power cannot be considered economical unless the nuclear power plant produces an acceptable quantity of fissionable isotopes in addition to its power and/or chemical byproducts."—A. V. H. Masket, University of North Carolina, before the recent Conference on Nuclear Energy at Michigan State College.

CONTROLLING WASTES

... A Proper Program

Process engineers at Naugatuck Chemicals in Elmira, Ont., claim they have solved most of their waste problems. Their control program, which they say helped quite a bit, shows prudent planning, both psychologically and technically. Before the recent meeting of the Chemical Institute of Canada, Naugatuck's W. J. Hogg, a process engineer at Elmira, showed off the program's skeleton.

Keystones of a control program:

1. Maintain good community relations; deal with all complaints immediately and sympathetically.
2. Place one qualified technical man in charge of the waste control program, preferably one who is familiar with all plant processes.
3. Publicize the program indicating full management approval of the project.
4. Set up an educational policy in the plant to reduce losses and show the plant personnel that this program is important.
5. Survey the plant for sources of pollution of air and water keeping in mind...
 - A. Control of dusts.
 - B. Adequate storage facilities to prevent fogs and fumes at storage tanks.
 - C. Change the processes for the best method of production to prevent undue wastes.
 - D. Check all possible sources such as vents, vacuum pumps, drying equipment and ventilation equipment for sources of pollution.
 - E. Re-use wastes where possible.
 - F. Carry out regular air sampling.

Five Things You May Not Know About Soil Conditioners

1. What a soil conditioner actually can do.
2. How much conditioner a soil really needs.
3. How a conditioner should be applied.
4. How practical are wet applications.
5. What the differences are between products.

When summer ends, the American gardening public may turn hoes down on all soil conditioners. Their antipathy could eventually spread to agricultural chemicals themselves, at least some producers believe so. Advertisers, who have been making some large claims for many of the new conditioners, they say, are principally responsible. "Only a few of these products, when used as recommended, are capable of producing any appreciable improvement in soil structure," says Research Director Howard K. Nason of Monsanto, whose company makes Krilium, the first of the conditioners.

To correct much of the general misinformation about soil conditioners—and probably to protect Monsanto's heavy investment in Krilium, Nason spoke recently to members of the American Seed Trade Association at their annual meeting in Detroit. His talk is the basis of this QED feature.—EDITOR.

1. Soil conditioners work only on certain soils.

Synthetic soil conditioners, like manures and plant residues, stabilize the clay component in soils against the dispersing or slaking action of water. However, they stabilize the silt components to a much lesser degree.

Prime purpose of soil conditioners, natural as well as synthetic, is to form stable agglomerates, or aggregates, with the clays and fine silts. The agglomerates themselves preserve the loose, porous condition of well-tilled soil.

The benefits obtained are substan-

tial. They include increased aeration, augmented water-holding capacity, improved workability, more favorable microbial relationships, faster germination, increased emergence, faster early growth, increased root formation, improved drainage, decrease erosion, decrease crusting, and ultimately improved crop response.

The more effective the soil conditioner, the more stable aggregates it forms. The effectiveness of a conditioner may be determined by measuring the proportion of such aggregates that remain stable in the presence of excessive amounts of water.

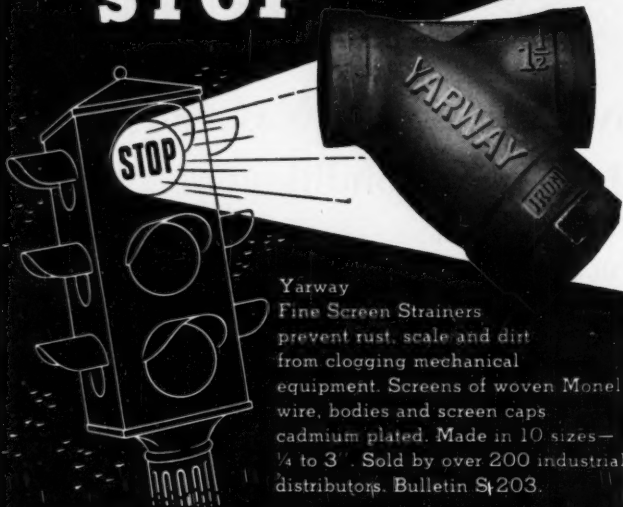
To date, soil scientists have made many such measurements. Collected data, they say, shows that soils high in clay sizes respond best, that soils high in silt particles will respond less markedly, and that sands will not respond at all to treatment with soil conditioners. Will a product effectively treat sand? To put it conservatively, such claims should be viewed right now with considerable skepticism.

2. Amount of conditioner used depends on many variables.

Soil conditioners act in a physical-chemical way. Sufficient amounts must, therefore, be used to get worthwhile results. The optimum proportion probably varies with the crop and with local conditions.

Only after extensive field studies can one know the correct proportion. However, in many applications it has been found that a grower needed enough conditioner to produce 50

SAYS **STOP** TO SOLIDS



Yarway Fine Screen Strainers prevent rust, scale and dirt from clogging mechanical equipment. Screens of woven Monel wire, bodies and screen caps cadmium plated. Made in 10 sizes— $\frac{1}{4}$ to 3". Sold by over 200 industrial distributors. Bulletin S-203.

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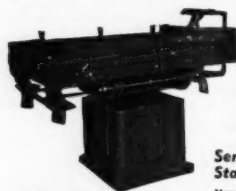
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Standard equipment on feeders for Schutz-O'Neill Pulverizers.



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For extremely fine grinding and uniformity of product, the principle of centrifugal impact with product carried by the air stream, has never been surpassed. Schutz-O'Neill Pulverizers utilize this principle to the fullest degree.

Send us stock sample State fineness desired

The Schutz-O'Neill Grater Sifter turns out a large volume of uniform, clean product. It is 3 above frame, for simple or multiple separation.

You will receive your pulverized stock plus our Engineering Report giving recommended equipment, methods and mill plans. Literature upon request.



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301 Portland Ave.,

Minneapolis 15, Minnesota

QED, cont. . .

percent stable aggregates in his soil. For a Putnam silt loam, he would need 1.75 lb. of Kriium to treat 100 sq. ft. to a depth of 3 in. For other conditioners, the amount required may be different.

3. A five-step procedure for proper application.

How then must you apply soil conditioners.

1. Before starting, make sure your soil is capable of improvement. That is, it is of a type which will give the desired response to treatment; for example, a soil containing appreciable proportions of clay and fine silt.

2. Mechanically prepare the soil. This may be done before or after application of dry conditioners, or before solution application, but it must be done thoroughly. Of course the moisture content of the soil should be high enough to permit tilling.

Conditioners stabilize soil structure but do not create it. If the preparation has not produced a loose, porous seed bed with soil clusters of desired size, the conditioner will not do a thing.

A conditioner must be placed where its presence is desired. Apply a conditioner to a hard, crusted soil and you will cause no aggregation or change in the mechanical condition of the crust. You may in fact stabilize the undesired condition. There is no royal road to riches here; mechanical preparation is essential for good results. And the job cannot be done with a garden hose from the vantage point of a lawn chair.

3. Determine the proper depth of treatment. For example: For new lawns, treatment to a depth of $\frac{1}{2}$ in. may be sufficient. For deeper rooting, such as in gardens, greenhouses and large-scale agriculture, treatment to a depth of 3 to 6 in. obviously may be required. Once in place and absorbed by the soil particles, the conditioner will not move appreciably with movement of ground water.

4. You can add conditioner in dry form or in solution. If solution, take care to use a sufficiently strong solution and to insure penetration to the desired depth. For most users, dry application will be more convenient and less toilsome.

5. Use an effective product. Most products now on the market would



Easy to Use G-E Hand Pyrometer Available With Two Scale Ranges

Simply flick a switch to change scale ranges on General Electric's new Type FH-1 hand pyrometer. This unique feature in the new FH-1 cuts testing time, eliminates use of several pyrometers.

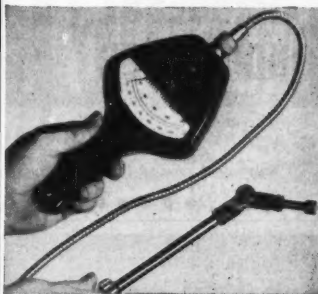
The Type FH-1 hand pyrometer is designed for rapid and convenient measurement of surface, liquid gas and molten-metal temperatures.

THREE INTERCHANGEABLE TIPS

A surface tip, an immersion tip for liquids and molten metals, and a 2-prong contact are supplied with the FH-1. In addition, a carrying case and flexible and rigid arms are provided for the FH-1. Both tips and extension arms are interchangeable in seconds.

AUTOMATICALLY COMPENSATED

Readings can be made directly for either scale of the instrument. With automatic cold-end compensation the FH-1 needs



no manual adjustment for variations in temperature in either the instrument or surrounding atmosphere.

See your nearest G-E representative today for complete information on the FH-1, or check coupon for GEC-836. Price of equipment shown in photo is \$118.17*

*Manufacturer's Suggested Retail Price

New Resistance Thermometers Accurately Indicate and Control Low Temperatures

TEMPERATURES FROM -100 F to +300 F can now be accurately indicated and controlled with General Electric's new line of resistance thermometers. They indicate accurately within $\frac{1}{2}$ of 1 per cent full scale. Any change in temperature equivalent to $\frac{1}{10}$ of 1 per cent full scale starts immediate control action.

Normal changes in humidity or room temperature do not affect the exactness of control. Neither does a change in control voltage. Sturdy, simple construction

assures reliable operation under severe operating conditions.

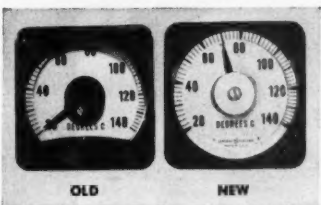
NARROW TEMPERATURE SPANS, as small as 90 degrees, are available anywhere in the -100 F to +300 F range. You can buy four types of resistance thermometers—indicators, protectors and two- or three-position controllers—for either flush or surface mounting.

For complete information, mail the coupon below.

G-E Thermocouple Potentiometer Accurate Within 0.2% Full Scale

This thermocouple potentiometer measures temperature in locations inaccessible to glass-stem thermometers. Readings can be taken in rapid succession and are accurate to within $\pm 0.2\%$ of full scale.

Typical applications include refrigerator-development work, oil-burner and air-conditioning tests, steam temperature measurements, and heat-run tests on electric equipment.



New Shadow-proof Temperature Indicators Are Easier to Read

Temperatures from -100 F to +300 F can now be accurately indicated with General Electric's new line of resistance temperature indicators. These instruments can be read from almost any angle. The dial is set forward, flush with the front of the case. A protruding convex-type glass front provides clear illumination. No more cover overhang; no more shadows caused by overhead lighting. Two sizes available— $4\frac{3}{4}$ and $8\frac{3}{4}$ inches. Check coupon.



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Please send me the following bulletins: Indicate:

- ☒ for reference only
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- ☐ Resistance Thermometer (GEC-835)
- ☐ Thermocouple Potentiometer (GEC-245)
- ☐ Temperature Indicators (GEC-565)
- ☐ Hand Pyrometer (GEC-836)

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**A UNIQUE
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FOR
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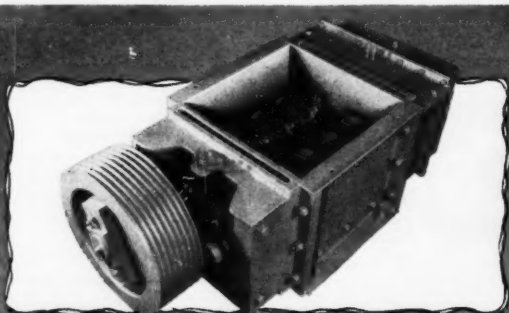
As an old established manufacturer of Chemical Equipment, we cover the U.S.A. with a team of high-calibre chemical engineers—all keen and experienced with excellent personal contacts throughout the chemical and process industries.

For some time we have felt that we could utilize this team to greater advantage by adding one or at the most two other specialty lines either on a national or regional basis.

In our own interests we must be selective and the line will have to be one that fits into the chemical and process industry.

If you are interested in the sales potential of a ready-made experienced and technically qualified sales organization, why not contact us and give us details of your product.

RA-4839, Chemical Engineering
330 W. 42 St., New York 36, N. Y.



PRATER Industrial Model CRUSHER-FEEDER
For First-Stage Reduction of Bulk Materials

This economical unit will reduce lumpy materials, from their original bulk state to an exact degree of uniformity as predetermined by the feed gate adjustment. The cast alloy cutting rolls—rotating in opposite directions toward the heavy duty shear bar—provide a powerful crushing action. The Prater Crusher Feeder is designed for heavy duty service.

It is compactly built, suitable for mounting independently, on a grinder or other process unit, or in close proximity. Quickly demountable rolls are easy to service. Fully enclosed machine-cut gears, running in oil, and safety shear pin hub on drive pulley add greatly to the life of the unit. Built in 4 types and sizes. Write for details and prices.

PRATER

PRATER PULVERIZER COMPANY, 1517 So. 55th Court, Chicago 50, Ill.

QED, cont. . .

be effective to a greater or lesser extent if properly used; however, many of them have improper directions. A few are complete nostrums of little or no effectiveness.

4. Wet applications are tedious and tiresome.

Can you apply conditioners as a water solution? Solution application will give satisfactory results if (1) the seed bed is thoroughly prepared mechanically; (2) sufficient conditioner solution is applied to soak the soil down to the desired depth; (3) the solution used is of proper concentration.

The last point may be overlooked, and with unhappy consequences. If too strong a solution is used, the polyelectrolyte will concentrate in the upper layer of the soil leaving lower layers improperly treated. If too dilute a solution is used, a large proportion of the polyelectrolyte molecules, which incidentally constitute the active ingredient of the conditioner, will not adhere to the clay particles, but will remain in the water phase and pass out of the surface soil unchanged.

How does wet application compare with the dry? In several experiments conducted by Monsanto, dilute solutions, tagged with radioactive carbon atoms in the polyelectrolyte molecule, were applied in large quantity to a soil sample, and the location of the conditioner molecules in the soil determined.

Under these conditions, over 95 percent of the conditioner molecules drained through the test soil and passed out in the water solution. Less than 5 percent were absorbed and retained by the soil. Little or no benefit could be obtained from such treatment.

On the other hand, when soil was treated with radioactive conditioner in dry form, or with solutions of the proper concentration, 98.9 percent remained firmly attached to the soil particles, and only 1.1 percent was leached out by prolonged immersion in large quantities of water.

5. All have the same base except Kriolum.

Since April of this year, 30 or more products have been rushed onto the market, in many cases with fantastic claims. With the exception of Kri-

ium 6 and its formulations, which are based on a modified vinyl acetate maleic polymer, Monsanto claims, all these products are based on hydrolyzed polyacrylonitrile formulated as the sodium salt.

Products are marketed in two forms: (1) the liquid forms are water solutions, containing generally 15 percent, or 18 to 20 percent solids, equivalent to about 1.3 and 1.8 lb. of solids per gal., respectively; (2) the solid forms contain about 20 percent or 83 percent of active ingredients. Some brands are reputed to contain fertilizing ingredients.

Monsanto says its Krilium is superior to other conditioners. On Miami silt loam, for example, it claims Krilium 6 is from 30 to 100 percent more effective at practical levels of aggregation than the product derived from acrylonitrile. On Putnam silt loam the margin is even greater, ranging from 100 to 310 percent. Similar differences, it says, have been found for other soils.

RECOVERING METALS

... Gallium Processed

Not being a noble metal, gallium recovery is difficult and expensive. Only from concentrates prepared during the recovery of some other metal has gallium recovery been possible. To date, most gallium comes from the processing of zinc ore in lithopone plants and bauxite in alumina preparation.

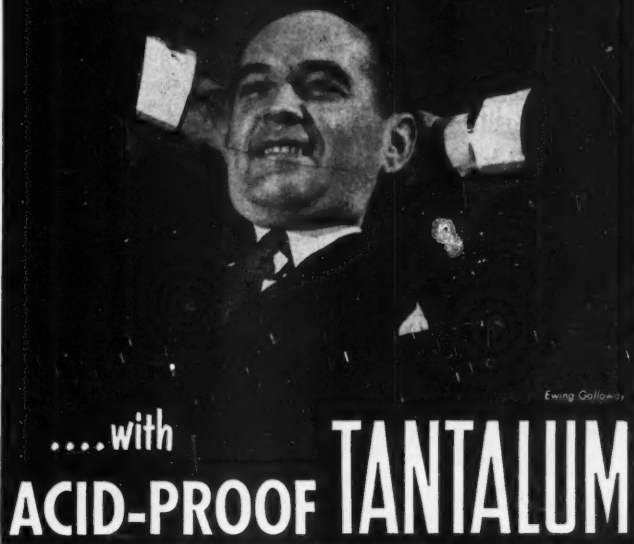
This spring, A. Paul Thompson and H. R. Harner described a working gallium recovery process, as practiced by Eagle-Picher, to members of the Electrochemical Society.

How It's Done—Impure gallium hydroxide and iron hydroxide are precipitated from a solution of zinc ore, and separated. The gallium hydroxide is converted to trichloride and purified by ether partition.

After purified gallium trichloride is converted to sodium gallate, it is electrolyzed in a bath using a copper rod cathode and a platinum anode. Voltage at 0.5 amp. per sq. cm. anode and 0.33 amp. per sq. cm. cathode is 5.5. This rate keeps the cell temperature well above 29.78 deg. C., the melting point of gallium. Liquid gallium collects in a porcelain crucible into which the tip of the cathode is inserted.

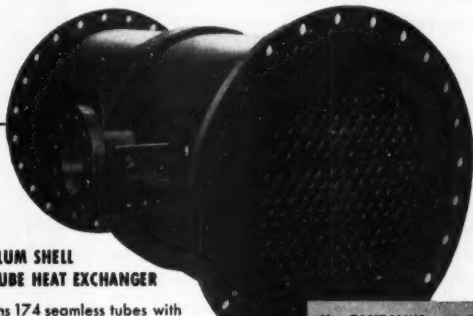
Cathode efficiency during the major part of the deposition is about 35 per-

"No Corrosion Troubles Since 1935"



....with
ACID-PROOF TANTALUM

"Way back in 1935 we found that the effective answer to acid corrosion troubles is tantalum heat exchangers. Not only are they really acid-proof, they will take high steam pressures—which speeds production—they require almost no maintenance, there is no thermal shock problem, and we know from experience they last a long time."



**TANTALUM SHELL
AND TUBE HEAT EXCHANGER**

Contains 174 seamless tubes with heating area of 187.5 sq. ft. Using 150-pound steam, this unit will transmit roughly 4,000,000 Btu per hour. Smaller or larger units can be built for your process.

Use **TANTALUM** with Economy for most acid solutions, corrosive gases or vapors; not with HF, alkalis, or substances containing free SO₃.

Consult Fansteel for designs and recommendations



Acid-Proof **TANTALUM**

22406C

Fansteel Metallurgical Corporation NORTH CHICAGO, ILLINOIS, U.S.A.

Here's the Seal
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Corrosion and
Temperature
Problems!

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WITH
TEFLON ★

The John Crane Type 9 Seal is designed to meet corrosive and high temperature conditions. That's because its flexible wedge and sealing rings are molded of the spectacular new plastic, Teflon, which is not affected by any industrial chemical, including solvents.

This revolutionary seal is the successful development of two years research and field testing. It's a perfect blend of John Crane experience in designing mechanical seals with the unique properties of Teflon: chemical inertness, extremely low friction and high heat resistance. Type 9 Seal can be employed at temperatures up to 500° F.

The result is a new, efficient way to handle corrosive liquids and gases that never before could be effectively controlled by conventional, flexible-type mechanical seals.

Prevents Leakage of:

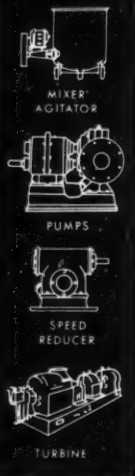
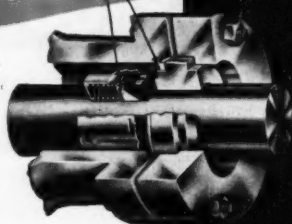
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INFLAMMABLE LIQUIDS
TOXIC GASES
CORROSIVE LIQUIDS
SOLVENTS**

Other John Crane Teflon Products include expansion joints, C-V Rings, packings and gaskets. Also, parts molded or machined to your particular requirements.

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CRANE PACKING COMPANY
1809 BELLE PLAINE AVE. • CHICAGO 13, ILLINOIS
Offices in All Principal Cities in United States and Canada



QED, cont. . .

cent, decreasing rapidly as the concentration of gallium falls below 2 grams per liter. Electrode spacing is 3 to 5 cm. depending on cell size. No agitation is used except occasional stirring to mix the layer below the anode. Above that level the heavy anodic gassing causes good agitation.

The crude gallium while liquid is given several alternate washes with distilled water, dilute hydrochloric acid and dilute nitric acid. Dark colored dross formed under nitric is removed by skimming. When no further dark dross is formed by this treatment, the gallium forms a bright mirror-like pool. Chemical cleaning now is considered complete.

The liquid metal, under very dilute hydrochloric, is allowed to cool to below the melting point (gallium may be supercooled to 0 deg. C. under some conditions), seeded with a bit of crystalline gallium and removed as gallium crystals.

After repeated recrystallization following Bureau of Standards method, the crystals are washed with distilled water, then alcohol. They are then dried, packed in Pliofilm bags and kept refrigerated. Gallium crystallizes in the orthorhombic system and gives a beautiful specimen. The exact shapes vary from thin plates to massive spear-points.

PREVENTING ACCIDENTS
... Know Your Limits

Not long ago, a graduate student, determined to get quick results on an experiment, returned to the laboratory around midnight. A 20-liter flask on his bench contained about 12 liters of benzene, some sodium and other reactants. At this time, he planned to add another reactant to the flask.

He took the flask and placed it in a cooling bath so the heat produced by the reaction could be slowly dissipated. The step called for the slow addition of the reactant over a period of 30 minutes; however, he added the reactant quickly—in three minutes. He was severely burned by the ensuing fire, hospitalized and a few days later died.

"The important point here is that this chemist, in spite of excellent technical training, failed to recognize the heat-transfer limits of the system," said Researcher H. H. Fawcett

CHECK THESE 3 WAYS YOU CAN SAVE WITH THIS MULTI-PURPOSE INSTRUMENT



Here is the most sensible idea you've ever seen in a recorder or controller—an instrument you can change as your instrument needs change, that you can add to, subtract from, or whose functions you can increase or decrease at little or no expense.

- ✓ Save money when you add new functions by adding only those new assemblies needed.
- ✓ Save time-delays by making changes on the job site without returning to factory.
- ✓ Save money on inventory. Parts are interchangeable, fit all Gotham Convertible recorders. You can service a whole group with a minimum stock of basic elements.

What you can do with the Gotham Convertible

Depending on the chart size of the recorder (6", 9" or 12") you can have a 1-2-3 or 4 pen recorder with 14 pressure, temperature and time operation combinations or a recorder-controller with 38 possible pressure, temperature, and time combinations.



SELF-CONTAINED PORTABLE RECORDER

A portable recorder which has a carrying handle, legs and retaining holder for capillary and bulb. Built from Gotham standard elements, interchangeable with other Gotham instruments. 6", 9" and 12" chart sizes. Mercury, Vapor or Pressure Activated. Spring or electric chart drive. See Catalog 400.



RECORDING PSYCHROMETER

Incorporates the same highly accurate and responsive thermal systems and contains all other Gotham standard convertible features. Wet and dry bulb type. Motor-driven suction fan, 12" chart size. Catalog 400.



RECORDING HYGROMETER

A 2-pen recorder of the wet and dry bulb type. Mercury or Vapor Activated. 9" and 12" chart sizes. Available with variety of wet and dry bulb assemblies depending on application. Catalog 400.



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- ☐ Catalog 100—Industrial Thermometers
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- ☐ Catalog 400—Recorders, Psychrometers, Hygrometers



- ☐ Catalog 500—Controllers
- ☐ Have your representative call. No obligation.

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"Hitch" Your CLARK Fork Trucks TO THESE Star Attachments

Every CLARK fork-lift truck saves money—a lot of money—for its user. Some save more than others because they are used more effectively—more efficiently—more regularly. They aren't allowed to stand idle "in between jobs." Demountable CLARK attachments enable them to do at great savings many jobs outside the popular concept of materials handling (snow plowing, coal shoveling and plant maintenance work, for example), and to do more and better jobs within that concept. Let CLARK help you make the most of and get the most from your fork-lift trucks. For your profit's sake, talk over your handling operations with the CLARK dealer nearest you—he's listed in the Yellow Pages of your telephone book.

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QED, cont. . .

of General Electric, who spoke to conferees at the recent meeting of the American Institute of Chemists in New York. "Safety consciousness had not yet become part of his thinking habits."

PREPARING CHARTS

. . . Human Equation

Editors of *Better Analysis*, house organ of Baird Associates, Inc., came up with a neat trick in a recent issue. In charting an analytical process, they used little drawings to represent the human element involved at each step.

Simple and highly routine human operation—little danger of human error.



Operation which requires skill, care or judgment—subject to human error.



A typical process in wet chemistry, when illustrated, would look like this . . .

- Prepare sample
- Weigh sample
- Dissolve
- Add reagent
- Filter
- Wash
- Burn off
- Weigh
- Calculate

MAKING PROFITS

. . . Researchers Take Note

What's the reason or purpose of industrial research?

"There is no business unless something is sold. There is no reason for industrial research unless its results are translated into the production of something that can be sold" says Vice President Paul D. V. Manning of International Minerals & Chemical Corp.

"Selling brings the income to the business. In the ultimate it provides



COOKED UP THIS COOKER . . . WHAT CAN WE COOK UP FOR YOU?



p-k will design and make any tailored or standard pressure cooker or any similar piece of process equipment to your exact specifications.

The pressure cooker shown is typical of **p-k** designing and manufacturing ability to meet specific requirements for specific processing operations. It is a stainless steel jacketed unit, with No. 4 polish inside, designed for 50 lb. pressure on both sides to meet ASME standards. The cover with an integral double-propeller agitator, is counter-balanced for easy cleaning and loading.

No matter whether your present needs are for a kettle, agitator, or any type of pressure vessel, **p-k** will work out an answer for you. Write **p-k** today—for specific design assistance or for more complete information.

Mixers • Coolers • Kettles • Agitators
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Stuck without WARNING

Who's stuck?

Safety valves that weren't safe? The plant which installed them?

None of this was necessary. If you want 100% safety—and you'd hardly want less—there's one sure way to get it—specify BalanSeal or FarriSeal Valves.

Why?

Because they *can't* stick, plug or corrode. Critical working parts are permanently isolated from any contact whatever with the lading.

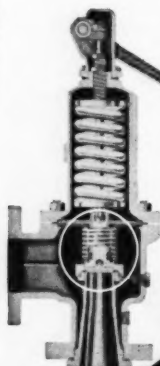
Because they're unaffected by back pressures in the discharge manifold due to its own operation or to the opening of other valves in the line.

Because these features make it possible for you to use smaller discharge piping, an economy which is often substantially more than valve cost.

You'll be interested in the engineering of BalanSeal and FarriSeal Valves—design which is rapidly gaining acceptance in hundreds of successful installations.

Ask for our "8-Minute Brief."

Your Safety's REAL With FarriSeal



Farri ENGINEERING CORP.
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QED, cont. . .

the money for the payroll and all other costs as well as the return to the shareholders. Research workers, scientists that they are, should never lose sight of that fact, and ridicule or belittle as purely mercenary, the commercial side of the business of selling the product they make possible."

MAINTAINING PUMPS

... Why Snowbound?

Here Are the Facts—We salvage chips of dry ice in our plant by liquefying them in a hot-water jacketed tank. Motor-driven pump takes suction from bottom of tank and discharges into a horizontal, insulated storage tank.

Carbon dioxide vapor formed in storage tank vents to liquefier through overhead line. After we run pump about 5 min., suction line and cylinder become plugged with dry ice.

Why does dry ice form in suction? How can we prevent it? Can we run pump continuously without ice and vapor?—TF, April, Power.

Here is an Answer—Five steps for curing the problem are: (1) Make suction head as large as possible; (2) keep suction-line friction losses as low as possible; (3) insulate suction line; (4) vent system and (5) chill pump casing with ice if there is too much flashing.

Increase suction head by raising jacketed liquefier or lowering motor-driven pump. This reduces flashing of liquid in pump suction. Flashing binds pump and pipe, preventing flow into pump. To prevent flashing, suction head must be great enough to overcome pipe friction losses, compensate for heat gains in the pipe and for vapor pressure of the liquid.

Run suction line from liquefier to pump in a straight line with as few fittings as possible. Keep line short and use a gate instead of a globe valve. To play safe, insulate suction line to prevent large heat pickup.

Run vapor equalizer to pump suction. Fit vent to atmosphere. With high friction loss, pressure drop between liquefier and pump may be large enough to permit flashing in pump suction. Liberally-sized pipes with few fittings and bends reduce friction loss to the point where flashing is not possible under ordinary running conditions.—JC, July, Power.

Here is an easy equation — HAGAN Ring Balance Meters = Dependability



Features of every HAGAN Ring Balance Meter include:

- Ease of dead weight calibration
- No stuffing boxes
- Adjustable, full scale range
- Mercury level not critical
- High sensitivity at low flow rates

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BOILER COMBUSTION CONTROL SYSTEMS
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METALLURGICAL FURNACE CONTROL SYSTEMS
CONTROL SYSTEMS FOR AERONAUTICAL
AND AUTOMOTIVE TESTING FACILITIES

WITH Hagan Ring Balance Meters you get accurate flow integration on oxygen, water, steam, gas, oil or other fluids. You get a meter that is rugged and sturdy, but still a precision instrument throughout. Design is simple and maintenance costs are low.

HAGAN RING BALANCE FLOW METERS are the most versatile meters available. A single meter unit can indicate, record, and integrate one or two flow rates. Standard modifications provide for pressure and temperature compensation. Ring assemblies are available which are capable of measuring differentials from 1" to 420" water column maximum and for static pressures ranging up to 15,000 psig.

For more information on how dependable Hagan Ring Balance Flow Meters can answer your metering problems, clip the coupon, or write, wire or call Hagan Corporation, Hagan Building, Pittsburgh 30, Pennsylvania.

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Please send me further information on Hagan Ring Balance Meters. I am particularly interested in _____

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QED, cont. . .

SAVING WATER

. . . Five-Step Program

In its plant operation, Westinghouse Electric Corp. wanted to save on water. After some thought, they came up with this five-step method.

1. Run a plant survey and find out where the water is going. Install meters for departments that are big users.

2. Establish a program to make everybody water-conscious. Post signs, get workers looking for leaks.

3. Put in self-contained regulating valves, automatic shutoffs, recirculating pumps.

4. Install cooling towers to allow wide reuse of water in various plant services. This will cost a lot and is usually applicable only to large plants.

5. Set up a policing system. Keep checking regularly to keep good water habits up.

Westinghouse got good results, *Power* magazine reports. In spite of a 36 percent increase in water rates in 1950, their bill was 5 percent under that in 1947.

DESIGNING PLASTICS

. . . Seven Tips

Remember these elementary engineering principles when you design plastic parts, advises Richardson Co. in its brochure "Facts about Plastics."

1. Eliminate large flat surfaces, or reinforce them with ribbing.

2. Draft on side walls should be approximately 1 deg. or more per side. Parts with a minimum taper, cost more in the end.

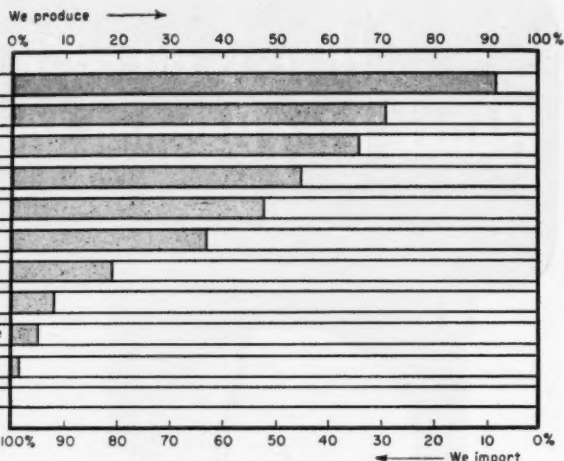
3. Add fillets, eliminate sharp corners except to facilitate mold-parting lines.

4. Threads can be molded. Small fine threads should be tapped after molding.

5. Inserts, when used properly, may mean new ideas. Be careful with them; keep in mind the difference in thermal expansion.

6. When you want a quotation, state the quantities and the number of pieces needed daily or weekly.

7. The mold is important in making both usable and precision pieces. Consider the mold as a long-range investment; its quality—not its price—deserves first consideration.



Quick Look at the Metals Situation Today

- America has become a have-not nation.
- Government has over-estimated present needs.
- Potential civilian demands are enormous.

This past spring, E. L. Shaner, Editor of *Steel*, spoke to members of the American Zinc Institute at its 34th Annual Meeting in St. Louis on the broad outlook for metals. His paper is the basis of this QED feature.—Editor.

The impact of two world wars in a space of less than a quarter-century has been tremendous. In World War I the initial heavy burden of armament fell upon European industrial nations, but long before Armistice Day on November 11, 1918, American industry started its contribution. In World War II, the U. S. carried an almost unbelievable production burden for the Allied cause.

Before these wars, we were quite complacent. We had abundant reserves of high grade iron ore and liberal supplies of copper, zinc and lead. Today, we have no exportable surpluses, unless it be in molybdenum and magnesium; we have to depend on imports.

Two major wars in quick succession have changed us from a "have" to a "have not" nation. This could be alarming if it were not for our still

decisive superiority in production over our potential enemy. In 1950, production of metals in free nations exceeded that of production in Soviet Russia and her satellites in every important category by substantial percentages.

However, slight shifts outward of Red armies at certain strategic points could envelop important sources of some of our most urgently needed ores and metals.

Here is a picture of the basic metal scene:

Iron Ore—The government has anticipated depletion of the Lake Superior ores by authorizing the investment of hundreds of millions of dollars in research and in plants for the treatment of taconite ores in the upper lake regions. We are also developing high grade iron ore resources in Labrador, Venezuela, Liberia and other foreign lands, not to mention some developments of lesser importance in New York and Pennsylvania.

We are increasing our facilities for producing coking coal, limestone and all the other ingredients required for making steel. We have been building blast furnaces, open hearths, rolling



Rolling Fabric Into Extra Profit

In the laboratory, it was easy. Laminate the vinyl film to an inexpensive fabric or paper and you have a plastic product ideal for a thousand everyday applications.

But making it a commercial success was a different story. New machinery had to be designed for low-cost, continuous sheet production of the vinyl film, laminated to either a fabric or paper base.

New heating and cooling units, designed by Lukenweld around its patented jacketed steel rolls, helped simplify the problem. Mounted in a welded steel frame, they provide safe operating pressures up to 150 psig . . . fast heat-up to over 360° F. when used for heating . . . efficient, even cooling with water or other

cooling medium when used to chill. Lukenweld's jacketed design confines steam or cooling medium to a shallow annular space close to roll surface, where heat or cold is most effectively utilized. Adaptable to either heating or cooling operations, these units permit temperature adjustment for quick switch-over from one material to another. Product purity is protected throughout by use of non-tarnishing stainless steel for roll faces.

For information on Lukenweld machinery for any flaking, drying, cooling or heating process, write: Lukenweld, Division of Lukens Steel Company, 400 Lukens Building, Coatesville, Pa.

Visit the Lukenweld Booth (#119) at the 7th National Chemical Exposition in Chicago—September 9 through 13.



Improved machinery for improved processes through engineering

LUKENWELD

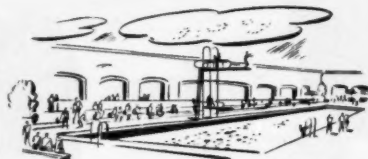
A DIVISION OF LUKENS STEEL COMPANY



FROM
**SERVICE
STATIONS...**



TO
**SWIMMING
POOLS**



CHECK CORROSION FROM ACIDS AND ALKALIES LONGER WITH



Fast-drying Parlon (Hercules chlorinated rubber) resists acids, alkalis, fumes, and salts three to four times longer than ordinary coatings. Two typical examples of the high protection Parlon gives to surfaces may be found in service stations and swimming pools.

In garages and gas stations, Parlon rubber-base paint on walls and floors resists the deteriorating action of grease, gasoline and other car servicing products. Where car washing is done, Parlon is ideal for protecting concrete, wood, and metal surfaces from alkaline cleaning chemicals and moisture.

Parlon has proved itself a favorite with swimming pool operators for many years because of its long underwater life. It is particularly durable on concrete pools, since it is unaffected by the free alkali in cement. Ask your paint supplier about easy-to-apply and economical-to-use rubber-base paint—or write direct for details.

Cellulose Products Department
HERCULES POWDER COMPANY
952 Market St., Wilmington 99, Del.

**RUBBER-BASE
(PARLON)[®] PAINTS**

CR52-4

QED, cont. . .

mills and their accessories at a rate which will give us a steel ingot capacity of between 117 and 118 million tons annually by the end of this year.

Copper—Unfortunately it is more difficult to increase copper than steel capacity. Although half a dozen companies are developing new properties, the new yield will not be available in appreciable tonnages for two years or more. This year the copper available in the United States, including imports, will be about 1,600,000 tons. When current domestic expansion is completed, and if we are successful in negotiating for increased imports from Chile, available supplies of copper might rise to around 1,900,000 tons late in 1953 or early in 1954.

Zinc—The available supply of zinc, around a million tons this year, will be increased within the next few years by about a third. Recently large deposits of zinc concentrates were discovered in Tennessee—a factor to be considered in appraising the future of zinc supply.


Lead—Our requirements for lead are about 1,200,000 tons annually. We had considerable trouble last year because of our domestic ceiling price. Tonnage was diverted to other countries that we could have imported to good advantage. Dropping of the import duty last February 12 and the subsequent abandonment of government allocations have helped a lot.

Aluminum—In the present emergency, aluminum is one of our most important metals. We are in the process of doubling capacity. Sometime in 1953 we will be able to produce 1,500,000 tons annually. In fact, aluminum soon will be challenging copper as the No. 1 nonferrous metal.

If we will be honest with ourselves we will recall that much of the pressure for increasing capacities came from the government. And it came at a time when there apparently were acute shortages in many ferrous and nonferrous metal products.

Today we can look back and see that some of these shortages were not as acute as they appeared to be. We know now that the military asked for certain scarce materials in amounts far beyond any reasonable need. For instance, officials of National Production Authority claim that because of over-estimates by the military, of the 1,433,000 tons of carbon steel allocated by NPA for the fourth quarter

PRECISION PERFORMANCE of PRESSURE VESSELS STARTS HERE



Precision controlled quality starts in Midvale pressure vessels when the molten steel pours from the giant ladles in Midvale's open hearths. From then until the final machining operation skilled hands build unsurpassed performance into equipment for the petroleum, chemical and other processing industries.

Midvale's experienced craftsmen and engineers are equally skilled in producing the finest in small vessels to withstand low pressures . . . or large forged steel vessels to stand pressures up to 9000 pounds per square inch.

For precision produced forged pressure vessels, heat and corrosion resistant castings, tube supports and hangers to your most exacting specifications let Midvale make them. Our engineers are ready to help you design them . . . our experienced men working with the most modern equipment can produce them.

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Custom Steel Makers to Industry

PRODUCERS OF FORGINGS, ROLLS, RINGS, CORROSION AND HEAT RESISTING CASTINGS



After
14 years
of tough
venting...

this TRANSITE* Industrial Vent Pipe is good for many years more!

This 80-foot Transite stack vents corrosive gases from a trunk sewer in a large city. In excellent condition after 14 years of service, it has already outlasted the original metal breechings.

Typical of the long service life you can expect from Transite Pipe in solving tough venting problems, this durable asbestos-cement product successfully resists a wide variety of corrosive industrial fumes, gases and vapors which seriously affect other pipe materials in a short time.

Because Transite Industrial Vent Pipe is non-metallic and is therefore rustproof, it requires no maintenance—needs no paint or other protective treatment. Due to its unusually high chemical stability, it has substantially

reduced replacement and maintenance costs in duct, vent and stack systems in plants across the country.

It is light in weight, easy to handle, easy to install, can be cut and drilled with ordinary tools. It comes in a complete range of sizes up to 36" in diameter... with a full line of rust-proof, corrosion-resistant Transite fittings which make it adaptable to practically any job requirement.

For further details on Transite for industrial venting, write to Johns-Manville, Box 60, New York 16, N.Y. Ask for Data Sheet Series DS-336. In Canada: 199 Bay Street, Toronto 1, Ontario.



*Transite is a registered Johns-Manville trade mark

Johns-Manville
TRANSITE Industrial Vent **PIPE**

QED, cont. . .

of last year, 438,000 tons were not used. Of 184 million pounds of aluminum allocated to the military in that quarter, 19 million pounds remained unused. Of 164 million pounds of brass mill products allocated, 32 million pounds remained unused. The same is true of many other supposedly scarce products.

In view of the present easing of pressure on most of the once tight metals, we may well ask ourselves whether or not we have been cajoled into expanding capacities foolishly. For example, if our present mobilization program should slow down, would civilian demand be sufficient to keep our expanded capacity reasonably busy?

Any sudden change from our present guns-and-butter policy certainly would necessitate an adjustment in our economy. The duration and severity of this adjustment would depend largely upon timing and other factors which cannot be predicted in advance.

However, as an offset of our present economic follies, we dare not overlook the country's unexpected growth. From 1930 to 1940 the population of the continental United States increased 7.2 percent. The experts figure that the increase in the decade from 1940 to 1950 might be about 8 or 9 percent. Actually the increase turned out to be 14.4 percent. Even more important is the 27.7 percent increase in the number of families during the decade. And today's parents are raising larger families.

Obviously the family unit means more economically than the per capita unit. It is the key factor in the markets for most goods produced by the metal-working industry.

Figures of the growth of families and of their disposable income mean much to manufacturers who fabricate the metals.

Analysts estimate that at the end of 1951 the market for electric refrigerators was 86.4 percent saturated. They calculate that by 1960, it will be 95 percent saturated and that annual sales of refrigerators will hover around the present level of just under 4 million units.

Among household appliances the market which stands second in saturation at present is that of electric ranges. It is 21 percent saturated now and the experts think it will be 43 percent saturated by 1960. Next are

QED, cont. . .

automatic washing machines. Their market is 12.8 percent saturated now and will be 39 percent saturated by 1960. Other figures, including saturation now and by 1960, respectively, are as follows: Electric water heaters, 11.6 percent now and 24 percent in 1960; food freezers, 5.8 percent now and 24.6 percent in 1960; garbage disposal units, 2.1 and 15 percent; dishwashers, 2 and 12 percent; and automatic clothes dryers, 1.1 and 16.9 percent.

Due largely to the surprising increase in the number of families, buyers of new automobiles have increased 75 percent since the end of World War II. More than 42 million passenger cars are on the roads today. Since 1948 car owning households have increased from 54 to 65 percent of the total number of households.

These figures show that the potential non-military demand for metal products in the U.S. is enormous. If the bottom dropped out of defense mobilization program tomorrow, this market, if properly exploited, should in a short time be quite able to keep all expanded capacity reasonably busy.

ELIMINATING SCALE

... A Sincere Worker

In high vacuum processing, scale formation costs a painful dollar—probably as much as corrosion damage. Besides cutting operational efficiency, it wastes operational time during shut-downs for descaling.

At French Lick, Ind., during the recent AIChE meeting, Carrier Corporation's E. J. Kelly told fellow chemical engineers that the falling film concentrator does a pretty fair job eliminating scale. "It is definitely a sincere worker when it comes to reducing scale formation," he says.

To prove his scaling point, Kelly described some surprising experimental results on the concentration of pulp maker's black liquor . . .

Calcium sulphite, which is the main scaling component in black liquor, fortunately, has an inverted solubility curve. But in experiments conducted, it was desired to find out if the falling film concentrator had any beneficial effect other than that of temperature.

It was found that in concentrating the liquor from 10-15 percent solids at 100 deg. C., that scale built up slowly

-SLY- PIONEERS & LEADERS in INDUSTRIAL DUST CONTROL

Do you make
any of these
products?

**DUST COLLECTION
IS CUTTING THEIR
PRODUCTION COST**

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Aero-Marine Engines
Diesel Locomotives
Marine Diesels
Spark Plugs
Carbon Black (tires)
Rubber (3)
Synthetic Cork & Rubber

Alloy for Steel
Strip Mill (sheets)
Metal Castings (5)
Petroleum Refining (2)
Oil Well Reactivators

Carborundum
Pyrometer Tubes
Mica Insulation
Optical Goods
Motor Controls
Jewel Bearings
Lead Oxides (3)
Storage Batteries
Detergents

Stock & Poultry Feed (7)
Fertilizer
Food from Soya Beans
Alfalfa
Grain Foods
Baked Foods
Agricultural Insecticides (3)
Dairy Cleansers

Cement
Building Board (2)
Building Granite (2)
Asphalt Products
Thermal Insulation (4)

Sulpha Drugs
Pharmaceuticals (5)
Textiles
Paints
Printing Ink
Printing
Electric Ranges
Shipping Containers
Clay Products (2)

The above list is *end products* as shown by a canvass of users of 71 consecutive Sly Dust Filter installations, made recently—not a handpicked list, just taken in sequence.



Bulletin 98—one of the most helpful booklets on dust collection ever written. Free on request.

Whatever you make, the probabilities are that dust collection can reduce your operating costs. Because of our fifty years' experience, and the advantages of Sly equipment in thorough dust collection and economies of operation, we believe we can save you money.

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ive use.

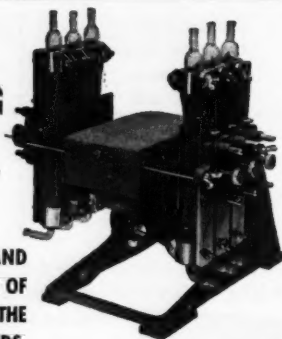
Advanced engineering design allows this rugged construction without making Ansul Extinguishers unduly heavy. Inexperienced operators can handle them easily and can extinguish much larger fires than one would normally expect from novice fire fighters.

SEE PAGE 283

BROSITES PROPORTIONING PUMPS

"6 in 1" PUMP

DESIGNED FOR LABORATORY AND PILOT PLANT WORK IN THE FIELDS OF CHEMICALS, FOOD AND DRUGS FOR THE METERING OF FREE FLOWING LIQUIDS.



THE BROSITES "6 in 1" PUMP is a unit comprised of six separate pumps operated by a common motor of fractional H.P. The equipment is capable of delivering a regulated flow from each single pump, and a specific output of one and up to six different liquids can be delivered simultaneously in desired proportion within the capacity of the unit.

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Model "O" Capacity 1 to 500 cc/min. per tube
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Total Capacity of Unit 7200 cc/min.

For complete description and specifications write for Bulletin No. 15

BROSITES MACHINE COMPANY INC.

50 CHURCH STREET (Cable Address—BROMACH) NEW YORK 7, N. Y.
TELEPHONE DIBBY 9-3600

QED, cont. . .

and operation could be sustained for 60 or more hours with only a slight decrease in heat transfer capacities. Using conventional rising film and forced circulation equipment, a decrease in heat transfer capacity occurred at the end of 24 hours of operation.

"More surprising was that the scale that formed was a soft scale, and could be removed surprisingly well by merely washing with water, whereas the scale found in the other types of evaporators was a hard scale, and had to be removed mechanically." The reasons are a lower temperature difference across the metal wall of the falling film concentrator, coupled with a lower film temperature and a washing of the heat transfer surface at all times.

"It is also to be recognized that by exposing only a thin film to the heating surface that there is very little superheating of the liquid, but rather the film is almost uniform in temperature."

Conversely, tubular equipment has a full load of liquid. To bring the center portion of the tube liquid to an operational temperature, it is necessary to superheat the film adjacent to the wall of the tube. Thus, explains Kelly, a preponderance of scale is formed.

MIXING FIBERS

. . . Compound Confusion

"There are so many different synthetic fibers available today that even textile technicians are confused . . ."

Cyanamid's C. W. Bendigo believes the layman compounds this confusion because he thinks of the fiber and not the form of the fiber. For example, nylon is not just nylon, it is nylon staple, nylon multi-filament and nylon monofilament. And properties of one form are not necessarily the properties of the other.

Other fibers are adding to the confusion. Newer variations of the cellulosic fibers differ much from ordinary rayon and acetate.

Old acrylic fibers, for example, were available largely in continuous-filament form and much information now in the trade reflects continuous-filament Orlon. But staple acrylics, which are the fastest growing of the

a pressure controller

*that's tough...
versatile...
dependable*

**Complete with every
feature you need**

SET POINT

Differential screw permits accurate adjustment of set point; no gears or other cumbersome devices.

OVERLOAD PROTECTION

Unique over-pressure safeguard prevents damage to control mechanism.

REVERSAL OF ACTION

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Light, compact case can be mounted wherever convenient: on valve yoke, wall, panel front, or flush in panel.

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Simplified design speeds cleaning, repair or replacement of sub-assemblies.



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HONEYWELL PRESSURE PILOT

A PRESSURE controller of unusual ruggedness and versatility, the Honeywell Pressure Pilot is an ideal means of regulating hydraulic systems, pipe lines, pump outlets and other applications where more expensive indicating and recording instruments are not warranted.

It utilizes a Bourdon tube sensing element, flapper-and-nozzle control assembly, and a pneumatic booster relay . . . all combined in a sturdy, low-cost unit capable of remarkably accurate control.

See the Pressure Pilot at first hand, right in your own plant. Our local engineering representative will be glad to demonstrate it; just call him today . . . he is as near as your phone.

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Widely useful as temperature measuring elements and as liquid level sensors, these temperature responsive resistors are built by Bendix-Friez under a system of quality controls set up to meet exacting military standards of accuracy. You can count on them as the very best obtainable, whether purchased from stock or made to your own specification. Ask for a list of applications.

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Size (inches)	@ +30°C.	@ 0°C.	@ -30°C.
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Typical application in capsule form for temperature sensing of hydraulic oil.

Write for details to Dept. G

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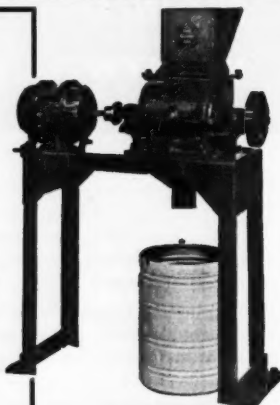
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QED, cont. . .

new synthetic fibers, have many properties quite different from filament. Furthermore, the three or four acrylics fibers in the field differ appreciably one from the other.

This situation can result in chaotic confusion unless corrected at once by those responsible for the selling of the newer textile fibers, says Bendigo.

GETTING METALS

. . . *Who'll Win Next War?*

"America is frighteningly short of ores.

"We are self-sufficient as a nation in only nine basic minerals and deficient in 23 others. Responsible men have said that though we were but a little short of any metal in the last war, we will be short of every one in the next, if there is one," says Robert F. Mehl, director of the metals research laboratory at Carnegie Institute of Technology.

Our only out: develop new techniques to produce the minerals we need. "Great effort is being expended on developing alloys for use at high temperatures. It has been said that the nation that wins the next war will be the nation that develops this alloy."

PROCESSING METAL ORES

. . . *Zirconium Powder*

Now used as a getter for residual gases in vacuum tubes, as a luminescent element in photo-flash bulbs, and lately as a fuel in ammunition primers, zirconium metal powder has recently been studied by Holger C. Andersen and Lawrence H. Belz of Foote Mineral Co. Particularly interested in the rapid burning property of the metal, they report. . .

"It was found experimentally that, just prior to ignition, the temperature inside a heap of Zr powder is greater than that near the surface. Also, the ignition point decreases with increase in sample mass. These observations are consistent with an auto-oxidation theory, in which heat of reaction, and conduction of heat away from the reacting mass, compete in determining whether ignition occurs.

"Addition of H₂ to Zr powder decreases its sensitivity and burning rate, but non-hazardous values are not attained until the composition appro-



Chemical Specialties?

Here's how
GAULIN
Homogenizers
improve them

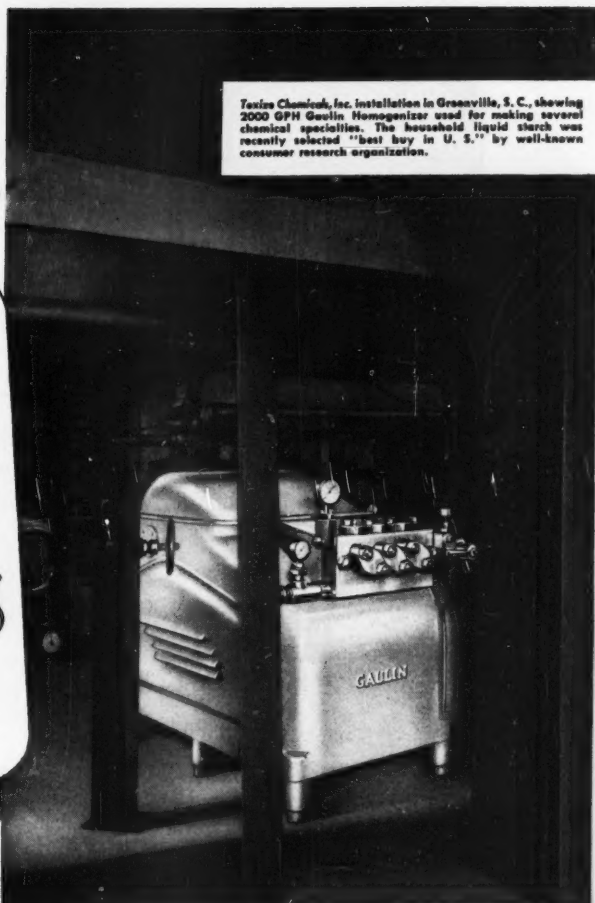
LIQUID STARCHES — A Gaulin improves transparency. Stops separation and clouding.

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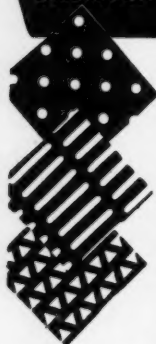


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QED, cont. . .

aches ZrH_2 . The activity of such a powder is reversibly restored by pumping off the H_2 . Zr alloys with Ni, Fe, Cu and Co. . . have about the same ignition properties as unalloyed Zr of comparable particle size.

"Ti powders made by calcium reduction of TiO_2 are less sensitive than Zr powders similarly prepared, but Ti-Zr powders made by reduction of mixed oxides retain nearly the sensitivity of Zr when the Zr content is 5 percent or greater."

PROTECTING POWER LINES

. . . Two Questions

What are the common sources of overvoltage?

(1) Lightning, (2) repetitive restriking, (3) resonant effects in series inductive-capacity circuits, (4) auto-transformers, (5) forced-current zero interruption, (6) static, (7) physical contact with higher-voltage systems and (8) switching surges, says General Electric's D. L. Beeman, who spoke before the recent meeting of the American Petroleum Institute's Division of Refining at San Francisco.

How can you reduce the effect of lightning on exposed circuits?

"One is to use shielding, which will largely eliminate direct strokes on the shielded portion of the line, and in many cases will reduce the voltage imposed by induction.

"In bad lightning areas shielding over higher-voltage open lines within the plant and for some distance out from the substation on lines supplying the plant may prove beneficial.

"Even with ground wires, very high induced voltage can be imposed on the system. Therefore, further protection is required to protect the transformers, switchgear, high-voltage motors, etc. This is accomplished . . . by lightning arresters," says Beeman.

GETTING ALUMINUM

. . . Why the Recession?

Right now, aluminum men find that the demand for their metal has softened considerably; in fact, some sections of the country say a definite recession is in progress. Why?

"In the first place, the military and defense program has now been stretched out over a considerably longer period than was originally announced. Production objectives originally set to be reached in 1953 have



It's the Nash!

The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

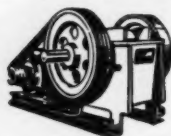
Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

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No valves, pistons, or vanes.
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Low maintenance cost.
Saves floor space.
Desired delivery temperature
Automatically maintained.
Slugs of liquid entering pump
will do no harm.
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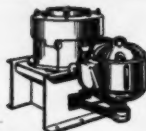
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Double acting jaw delivers two blows per revolution, speeds crushing. Forward and downward motion increases capacity over conventional stroke, particularly on moist materials. Hand wheel replaces usual wrench or shims for jaw opening adjustment. Discharge openings $\frac{1}{4}$ " to $1\frac{1}{2}$ " available. Welded steel construction. Reversible jaw plates.



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Reduces $\frac{1}{2}$ " feed to as fine as 10 mesh in a single pass. Very high capacity and low power consumption; replaces bulky, unhandy equipment such as rolls and coffee mill. Sizes available, 6" and 10".



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The Masco-McCool is a disc-type grinder designed for pulverizing to fine meshes in one operation. Planetary disc movement assures long grinding surface life. No gears—reduces power; 100% anti-friction grease lubricated bearings; grinds more samples per hour at lower cost.

New free CATALOG gives complete information on Masco laboratory crushers and pulverizers; Marcy grinding mills for laboratory, pilot plant and commercial grinding; Masco-Grigsby rubber pinch valves.

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QED, cont. . .

been moved back—some to 1955 and others to 1956 or 1957. Naturally this reduces the amounts on the monthly mills schedules.

"Secondly, there has been a serious mal-distribution of aluminum products because of emphasis on certain military needs, coupled with the present inflexibility of allocations under CMP—thus preventing many customers who would actively be seeking aluminum from getting it in practical amounts.

"On top of that is the industry-wide expansion program which is bringing new aluminum smelting capacity into operation right along.

"If controls are wholly or substantially removed, many manufacturers who have had to curtail production of aluminum products, or who have been forced to drop altogether certain lines or items using aluminum, would rapidly get back into production."

—D. Wilmot before the Pittsburgh Purchasing Agents Association, May 20, 1952.

TRAINING PERSONNEL

. . . For New Facilities

Here's how Esso Petroleum Co., Ltd., went about training personnel to run a new expansion.

It was a tough problem. At its Fawley refinery, Southampton, the company had to add 1,350 new employees to an existing staff of 850, most of whom would know nothing about petroleum refining. The 850 men were fully engaged in operating the existing refinery.

First step was to recruit fresh employees for the existing plant, which had to be kept operating. Men were selected to operate the new facilities, systematically promoted and intensively trained.

Supervisory Training was divided into two phases:

1. Applied training on new units and equipment: Key men were sent to the U. S. for special training, study and discussion of operating manuals.

2. Formal courses were given:

Principles of Management—for 24 of senior refinery staff. Time required was 18 hours.

Basics of Supervision—for first line foremen; 95 men studied such subjects as Job Instruction and Personnel Policies.

Conference Leadership—for select individuals who might need to train others in the course of their work.

Orientation courses—for super-



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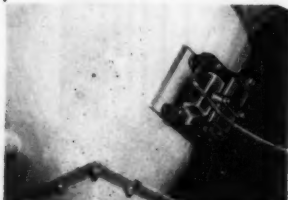


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with variable control of power



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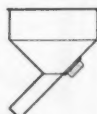
Wooden
Hoppers



Concrete
Hoppers



Inclined
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Hopper with
Sloping Discharge

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This Plant Claims Their

HEAT SAVINGS PAID for NICHOLSON TRAPS

Nicholson expansion steam traps were installed by a processor on tank heaters and coils where various unit temperatures from 160° to 185°F had to be maintained. The steam temperature was 320°F. Figuring the difference in heat loss between Nicholson traps discharging con-

densate at 160° and others discharging it at about steam temperature, they feel heat loss was cut nearly in half. Due to their effectiveness in controlling temperature as well as draining condensate, Nicholson traps are paying for themselves in many industries.



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TRAPS · VALVES · FLOATS

QED, cont. . .

visors. Instructors explained how each department and plant fitted into the rest of the organization.

Long-Range Needs—To meet future promotion requirements, the company started a program to round out and extend the skills of its employees. First phase covered basic orientation: layout and operation; rules, instructions and procedures; location and purpose of new units and equipment; operating principles, pipelines and controls; and hazards and safety precautions.

Second phase covered job training: coaching and tryout on duties in operating and servicing equipment; information and reasoning required for each job; common emergencies and their causes; and methods for working in safety.

Process workers spent about 80 percent of their training time on orientation and 20 percent on on-the-job training. Mechanical workers spent 10 percent in orientation and 90 percent in on-the-job training. After instruction and field work, the progress of each man was checked and recorded on a training chart.

CHEMICAL RESOURCES

. . . *Enough Oil?*

To supply oil for the world in 15 years, annual production must rise to 1,200 millions tons of crude a year, says the National Petroleum Council. This is double current production.

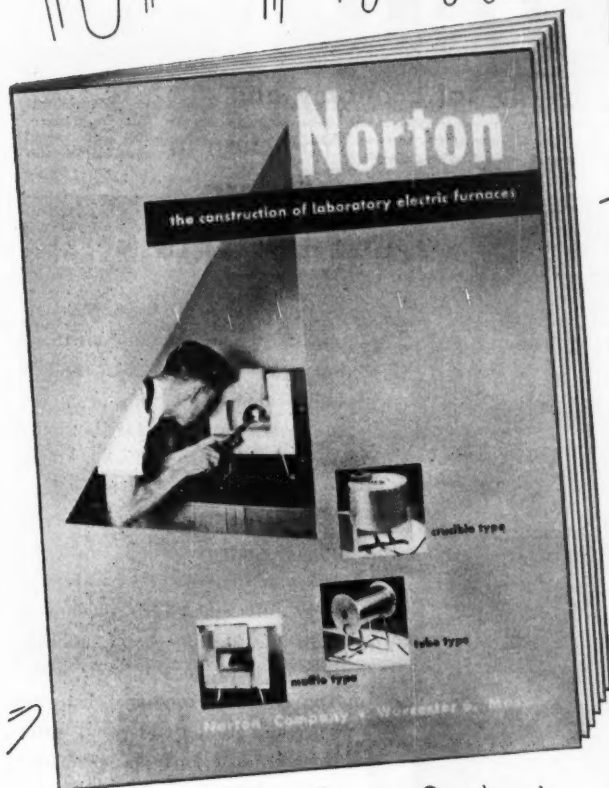
An expert committee of NPC, made up of representatives of all major U.S. oil companies, has recently surveyed the present and future sources of oil and gas. Underground supplies in the U.S., they report, hold plenty oil, and resources are even more abundant elsewhere.

Plenty—New oil findings are enormous. In the U.S., sedimentary areas, now regarded as oil bearing, are about 100 times as large as all the oil and gas areas previously discovered, and extend well over 1.5 million square miles. Large new areas are now accessible under the Continental Shelf. Overseas, favorable areas are 10 times as large as those in the U.S.

Middle Eastern reserves are already twice as large as those of the U.S. Latin America is in its early stages of development. Canada is just starting.

But—Mere existence, however, is not availability. Recent technological improvements have greatly increased production, but technical knowledge and skill ultimately depends on economic factors. End

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authoritative data on
high temperature
furnaces...

shows how to build
them...contains practical,
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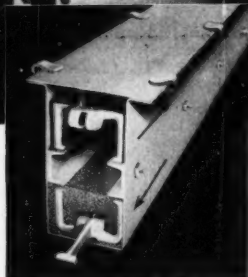
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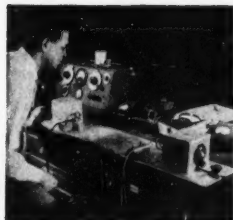


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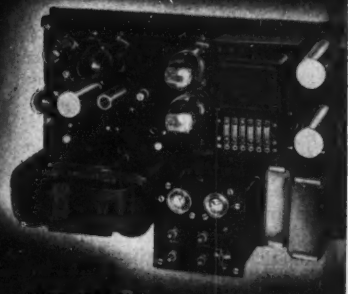
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Chemical Engineers' Bookshelf Edited by Lester B. Pope

Team Effort

PULP AND PAPER MANUFACTURE. Vol. 2. Edited by J. Newell Stephenson. McGraw-Hill Book Co., New York. 587 Pages. \$7.50.

Here is a fine example of a well integrated team effort producing an important contribution to the literature of an industry. Sponsored by a joint committee of the Canadian and U.S. pulp and paper industries this second of four projected volumes deals with the preparation of stock for paper making. When completed this current series will supplant volumes III, IV, and V of the earlier series entitled "The Manufacture of Pulp and Paper."

Experts from many segments of the paper industry and its equipment suppliers have contributed to the store of knowledge contained in Vol. 2. Valuable time-tested art and science of stock preparation are skillfully and completely blended with recent developments to present a well rounded picture. Of particular interest is the evidenced increase of knowledge based on scientific fact which has been gradually changing papermaking from an art to a science.

As a reference this volume gives detailed operating conditions and answers why those conditions are used. Hard-headed practical operating experience among contributing authors has supplied numerous examples of operating difficulties and means for avoiding them.

The first section of the book is concerned with the preparation and pulping of all types of fibrous materials other than wood fiber which is detailed in Vol. 1. This includes treatment of reclaimed as well as virgin fiber.

Other sections cover beating and refining, fillers and loading, sizing and coloring.

The last section delves into the far reaching modification of pulping practice centering around semi-chemical, high-yield chemical and special ground wood pulping processes.

Chief criticism—organization of material is such that there is consider-

able duplication of illustrations and text between sections on refining of paperboard stock and the general subject of refining and refiners.—CSC

Theory & Data

ABSORPTION AND EXTRACTION. Second edition. By Thomas K. Sherwood and Robert L. Pigford. McGraw-Hill Book Co., New York. 478 pages. \$7.50.

Reviewed by M. J. B. Bogart

This important work, virtually rewritten since the first edition in 1937, remains an authoritative treatise on gas absorption. A greatly amplified second edition has resulted from the inclusion of the major published absorption theory and data over these fifteen years. In addition to the entitled unit operations such related subjects as thermal diffusion, gaseous effusion, bubble-cap plate capacity and efficiency, and hydrocarbon vapor-liquid equilibria have been discussed.

Two full chapters have been devoted to molecular and eddy diffusion, followed by a chapter each on interphase material transfer and on combined heat and mass transfer, the theoretical limitations being clearly defined. Other chapters cover multi-component absorption, equipment design and performance, and simultaneous absorption and chemical reaction. The book is liberally sprinkled with illustrative examples.

A detailed treatment has been presented of the basic theory and application of mass transfer coefficients for single solutes, which has formed the basis of an abbreviated and simplified derivation of the concept of transfer units. Both of these indices of performance are used in the subsequent treatment of the design and evaluation of absorption equipment.

The book does not have as strong an emphasis on commercial practice as on theory. Fault may be formed with the statement of the authors that stepwise calculations are mainly of theoretical interest and that hydrocarbon absorbers almost invariably employ non-volatile absorption oils. Nevertheless, this book should prove to be a valuable text and reference

work on gas absorption for both students and industrial workers.

As in the previous edition, a single chapter is devoted to the theory and application of liquid-liquid extraction. A general review of this subject is given, including a brief presentation of the use of the triangular and Ponchon diagrams, transfer unit calculations and capacities of packed extraction columns.

Comprehensive Summary

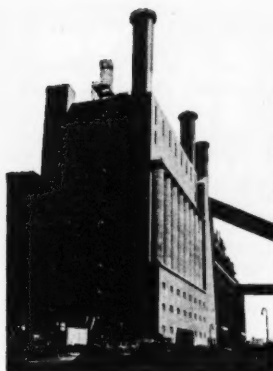
TEXTBOOK OF ELECTROCHEMISTRY. Vol. II, By G. Kortum and J. O'M. Bockris. Elsevier Press, Houston. 882 pages. Price \$10.

Reviewed by Henry C. Miller

This second volume of the English edition of Kortum's book continues the development of electrochemical principles started in Vol. I with chapters on electrical phenomena at interfaces, irreversible electrode processes, and electrochemistry of gases. In these chapters the technical literature is reviewed quite thoroughly, with many English language references included. The sections on corrosion, overvoltage, and electrical discharge in gases are excellent, but that on polarography is much too short. There is only incidental mention of industrial application of electrochemical processes.

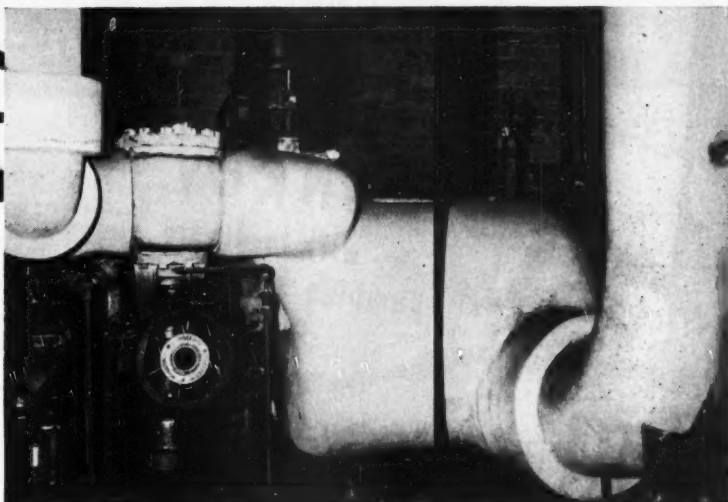
Following the chapters on principles is a very interesting one on experimental methods. Here, as in Vol. I, the authors' stress of clear understanding of fundamentals is shown by their giving a short review of alternating current and thermionic valve theory. Unfortunately, this section had to be quite brief, and hence is of doubtful value. The rest of the chapter is a very fine review of experimental methods used in electrochemistry, covering topics as varied as absolute measurement of current to the measurement of variations in overpotential with time.

The last chapter, of 160 pages, contains tables of physico-chemical properties which should prove a convenient source of useful information for both the experimental and theoretical electrochemist. (Continued)



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(Above) View of recently completed annex to Consolidated Edison's power plant... another link in their gigantic expansion program. (Right) Close-up of J-M 85% Magnesia Insulation on boiler feed lines. It was expertly installed by the Asbestos Construction Company, Inc., an outstanding J-M Insulation Contractor.



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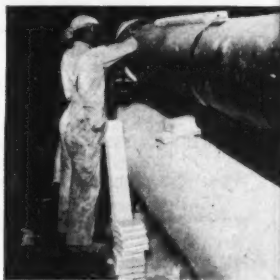
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BOOKSHELF, CONT. . .

Vol. I and II give a very comprehensive summary of modern electrochemistry. It is presented in a convenient manner for the advanced student and the research worker to understand and to use.

Cascades

THE THEORY OF ISOTOPE SEPARATION. By Karl Cohen. McGraw-Hill Book Co., New York. 165 Pages. \$2.

Reviewed by Arthur L. Levy

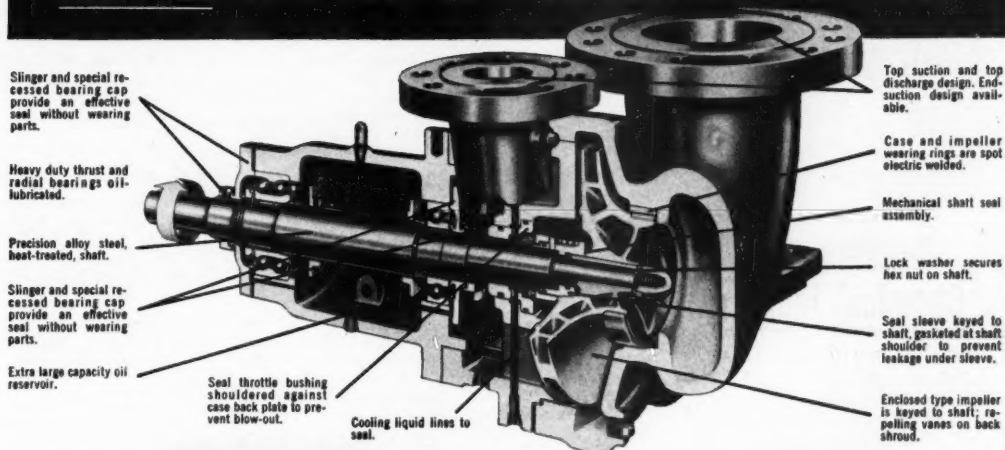
Separation of isotopes in binary mixtures is the only concern of this book. However, the emphasis is not on any particular method of separation. The largest portion of the book is devoted to the problem that most of the separation methods do not produce a large enough change in isotopic abundance in a single step and that, consequently, there must be efficient multiplication to get large amounts. Out of a total of seven chapters the first five are devoted to developing a general theory of cascades, that is, the theory of the multiplication problem. The remaining two chapters treat the applications of the theory to specific separation methods—centrifugation, thermal diffusion, chemical exchange, and distillation. In addition, there are five appendixes containing special results, graphs, tables, and extensions of mathematical details.

Cohen indicates how solutions to various equations involving ideal and non-ideal cascades can be obtained and gives tables and graphs of various constants and functions that are needed. He shows how cascades may be most efficiently combined and that deviations in flows up to 20 percent from those calculated do not appreciably affect isotopic separation. His chapter on the control problem would be of greatest interest to chemical engineers. In it he describes the effects of various fluctuations in operating conditions on the concentrations and production rates of the desired isotope.

The book does not make for easy reading. Its mathematical detail and complexity make it suitable primarily as a theoretical handbook for someone already deeply immersed in the problems of isotope separation. Most chemical engineers would find the terminology and methodology quite different from that to which they are accustomed.

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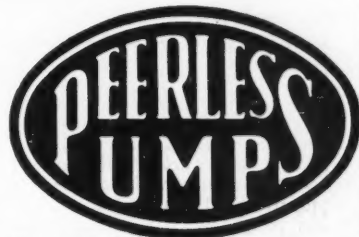
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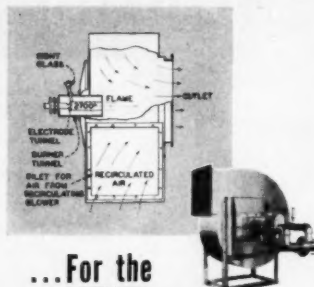
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How to Order

"Shelter from Atomic Attack in Existing Buildings, Part II." FCDA Technical Manual 5-2. Supt. of Documents, Washington 25, D. C. 15 cents.

Expansion Joints

Design of shell expansion joints as used in fixed-tube sheet heat exchangers. Results of tests on one design of heat exchanger expansion joint. Procedure for calculating the stresses and deflection for this expansion joint is proposed and compared with tests results. 30 pages.

"Expansion Joints for Heat Exchangers." By S. Kopp and M. F. Sayre. American Locomotive Co., Dunkirk, N. Y.

Chromite

Two booklets cover geological investigations of two counties in the Klamath Mountains. Four booklets cover counties of the Sierra Nevada region. Numerous maps, photographs and diagrammatic illustrations.

"Geological Investigations of Chromite in California." Bulletin 134. California Dept. of Natural Resources, Division of Mines, Geologic Branch, Ferry Bldg., San Francisco, Calif.

Distilled Spirits

Statistical presentation of the operations of the beverage distilling industry during 1951. Report compares the various activities of the industry during 1951 with the preceding year. 48 pages.

"Annual Statistical Review." Distilled Spirits Institute, 1135 National Press Bldg., Washington 4, D. C.

Oil Gasification

Relationships of the physical and chemical characteristics of petroleum fractions, and of the operating variables, with the enriching values and with the qualities and quantities of the gaseous and liquid products. For the more common gas-making oils, these data are given in graphic as well as tabular form. Two booklets: one on high-BTU oil gas, 48 pages; one on carbureted water gas, 52 pages.

"Selection of Oils for High-BTU Oil Gas." Bulletin 12. "Selection of Oils for Carbureted Water Gas." Bulletin 9. By E. S. Pettyjohn and H. R. Linden. Institute of Gas Technology, 17 West 34th St., Technology Center, Chicago 16, Ill. Bulletin 12: \$5; Bulletin 9: \$4.

Safety

Physical protection of industrial facilities, particularly those which are vital to mobilization for defense. Topics discussed include: entry control, espionage and sabotage; fire defense measures, accident prevention. 53 pages.

"Standards for Plant Protection." Office of Industrial Security, Munitions Board, Department of Defense. Supt. of Documents, Washington 25, D. C. 20 cents.

Molasses

Study of use trends: declining industrial alcohol market; expanding livestock feed market. Much data is in tabular or graphic form. 69 pages.

"Marketing Industrial Molasses." By B. K. Doyle. Bulletin 82. U. S. Dept. of Agriculture, Production and Marketing Administration, Sugar Branch, Washington, D. C.

Research

Brief descriptions of all of the institute's research projects. Photographs. 50 pages.

"Research Proceedings of Mellon Institute, 1951-1952." Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh 13, Pa. Gratis.

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"Square and Hexagon Bolts and Nuts." Standard B18.2-1952. American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y. \$2.

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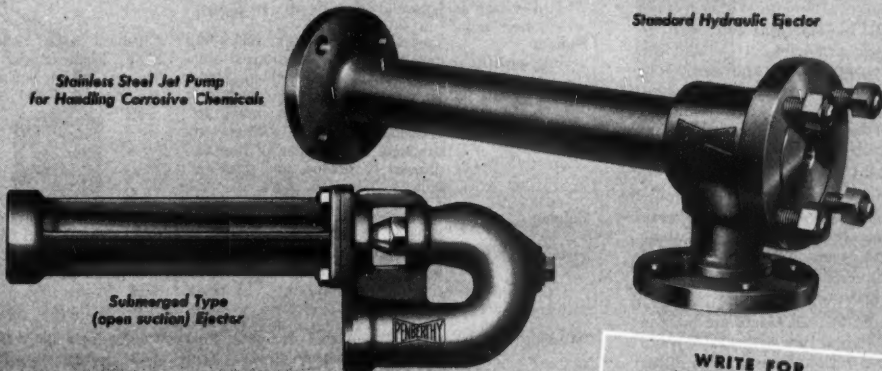


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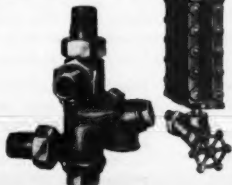
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RECENT BOOKS & PAMPHLETS, cont.

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Industrial Waste	How to conduct a liquid-waste study in a manufacturing plant. Methods of measuring flow volume, obtaining representative samples and calculating waste load.	"Planning and Making Industrial Waste Surveys." Ohio River Valley Water Sanitation Commission, 414 Walnut St., Cincinnati 2, Ohio. \$1.
Sewage Plants	Step-by-step explanation of legal requirements in Ohio for sewage disposal, the manner in which an engineer is retained, how financing is planned, conduct of other practical measures to expedite construction.	"How To Get Sewage Treatment Plants in Ohio." Ohio State Dept. of Health, State Office Bldg., Columbus 15, Ohio. \$1.
Safety	Types of fire retarding paints available. Lists many formulas. Outline of what would be necessary for a good fire retarding paint.	"Fire Retarding Paints." By Leon Sternberg. Chemit Co., 247 Belmont Ave., Brooklyn 7, N. Y. 50 cents.
Flooring	For printed-enamel felt-base floor covering: how to measure weight, overall thickness, thickness of enamel and of seal coat, resistance to scrubbing with cleaning compound, resistance to kerosene, flexibility, tearing strength. 10 pages.	Standards Building Materials and Structures Report 130. Supt. of Documents, Washington 25, D. C. 15 cents.
Sodium	Covers sodium, sodium metal and metallic sodium. Authorized shipping containers for sodium, proper housing of tank cars for loading or unloading the molten metal, recommended storage facilities. Instructions for handling of fires and disposal to residues and scrap metallic sodium. 13 pages.	Chemical Safety Data Sheet SD-47. Manufacturing Chemists Assn., 15th and H Sts., Washington 5, D. C. 25 cents.
Sulphur	Discussion of sulphur sources in Britain. Details of many methods of conserving sulphuric acid, mainly in the fertilizer industry and in iron and steel pickling. 25 pages.	"A Survey of the Sulphur and Sulphuric Acid Position." Dept. of Scientific & Industrial Research, Charles House, 5-11 Regent St., London, S.W. 1, England. 40 cents.
Welding	Revised standard. Includes provisions for the use of automatic welding in the fabrication of storage tanks for storing liquids at not over 15 psig. Requirements for manual welding have been reviewed and brought up to date. 23 pages.	"Rules for Field Welding of Steel Storage Tanks." American Welding Society, 33 West 39th St., New York 18, N. Y. 50 cents.
Stainless Pipe	Standards for tubular products of dimensions and materials commonly used for pipe lines and connections. 5 pages.	"American Standard Stainless Steel Pipe." ASA B36.19-1952. American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y. \$1.
Tubular Exchangers	Standard nomenclature, material specifications, thermal standards, maintenance suggestions. Mechanical standards for carbon steel and nonferrous alloy construction both for Class R and Class C heat exchangers. Complete mechanical standards for alloy steel construction known as Class A. 162 pages.	"Standards of Tubular Exchanger Manufacturers Assn." Third edition. TEMA, 53 Park Pl., New York 7, N. Y. \$5.50.
Pharmaceuticals	British pharmaceutical industry representatives view and analyze all operations subsequent to the manufacture of the essential chemicals necessary to prepare pharmaceutical products for the market. Their recommendations as to what should be adopted at home. 68 pages.	"Report of the Anglo-American Productivity Team on Pharmaceuticals." Assn. of British Chemical Manufacturers, 166 Piccadilly, London, W. 1, England. 3s.



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FOAM USED TO COMBAT STUBBORN PLASTICS FIRE

Carbolic acid fumes generated by 150 tons of burning plastics bowled over 31 firemen last December, in a grueling 12-hour battle with flames that swept a West Chester, Pa., warehouse.

When water failed to smother the blaze, National Aer-O-Foam was used to bring the fire under control. Later, a bulldozer pushed the smoldering mass of sheets from the warehouse to the street, where firemen snuffed out the burning residue. Damage to the building was estimated at \$200,000.

Send for Your Free FOAM FACTS Subscription

We'd like to send you a free subscription to FOAM FACTS. This quarterly publication is full of interesting data and helpful information on foam fire protection.

It's yours for the asking. Just mail your name and address (and the name of anyone else at your plant who should receive it) to National Foam System, Inc., West Chester, Pa.

Foam System Protects Sunken Fuel Oil Tank

National Foam engineers recently solved the problem of giving complete, always-dependable foam fire protection to a 120-foot sunken fuel oil tank. Manpower at the tank was limited to a single workman, so the equipment for liquid proportioning could require no supervision at any time.

The Aer-O-Foam system to meet this need involved the use of nine line proportioners, taking suction from a 1,000-gallon tank of Aer-O-Foam Liquid. Discharge piping was connected to a header which ran to three laterally-connected MCV Foam Chambers on the roof of the tank.

In case of fire, the city pumper takes suction from a near-by hydrant, hooks to a fire department connection outside the building, and pumps water at approximately 150 psi. Aer-O-Foam Liquid is picked up by the proportioners, and solution is piped to the foam chambers, where resultant foam is delivered to the burning surface.

This system completely satisfied the need for foolproof operation, and was approved by the city fire department.

FOAM LIQUID FIGHTS POLAR SOLVENT FIRES

Aer-O-Foam "99", newest foam product in the list of National Foam "firsts," now fills the long-felt need for a mechanical foam with universal application.



Thoroughly tested, it is designed for use on fires involving alcohols, ethers, esters and related oxygen-bearing polar solvents, as well as petroleum products. Lower installation cost, less manpower needed, and a wider range of approved devices are just a few of the advantages of the mechanical foam system. Where automatic operation is desired, it is a simple matter to adapt mechanical foam systems to meet specific plant requirements.

Aer-O-Foam "99" forms a tough, fire-resistant blanket of foam which will not break down nor readily disintegrate, but adheres to and insulates all types of surfaces.

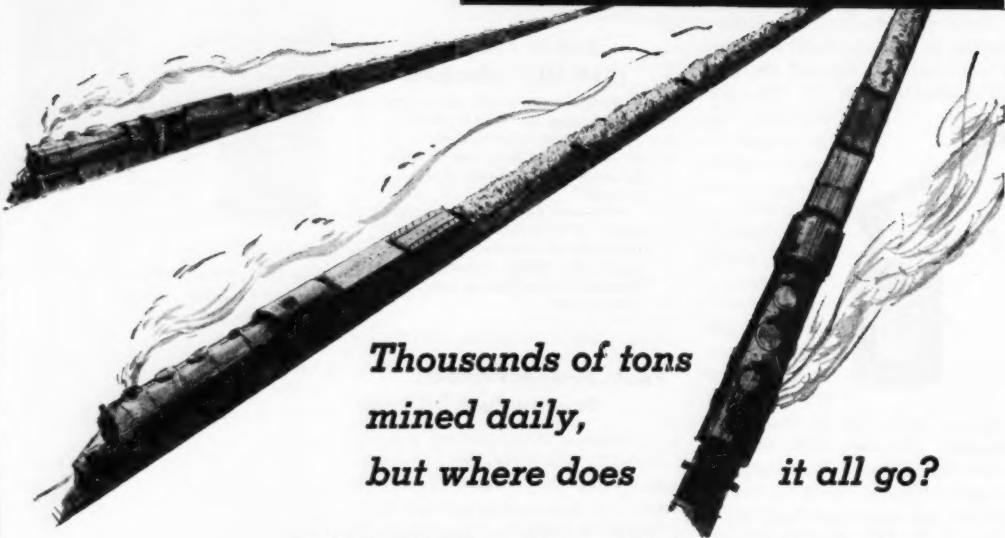
DRENCH Extinguishes Huge Sawdust Pile Blaze In South Dakota Mill

Drench, a National Foam product which not only makes water wetter but also increases its depth of penetration, recently was used to extinguish a fire in five carloads of sawdust.

The shipment of Drench was made by air to a South Dakota mill owner who had discovered a spontaneous combustion fire in a huge pile of sawdust and shavings.

"We were well pleased with the results of Drench," the owner said. "The solution really penetrates sawdust, and results in a very much smaller consumption of water. We used it with a fog nozzle, and found this very satisfactory."

Sulphur



*Thousands of tons
mined daily,
but where does it all go?*

LOOK AROUND YOU and let your glance fall on any object. The chances are 1000 to 1 that sulphur played an important role in its manufacture, either as a component part of the finished product or as a processing element.

Take, for example, the very magazine you are reading. If it's average size it weighs about 1 pound. Made largely of sulphite pulp it required about 0.1 pounds of sulphur in its manufacture.

Multiply this 0.1 pounds of sulphur by the thousands of magazines turned out every day and you'll get some idea of the tremendous tonnage of sulphur required for this single division of industry . . . the sulphite pulp manufacture.

Sulphur has long been called One of the Four Pillars of Industry. Today's need emphasizes this fact more than ever. Sulphur producers are making every effort to get maximum production from existing mines and to develop new sources of sulphur as quickly as possible.



Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.



Mines: Newgulf and Moss Bluff, Texas

Now... closer temperature approaches in heat exchange



WITH **TRANE** BRAZED ALUMINUM SURFACE

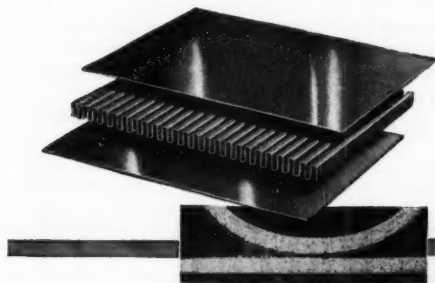
Now... even with a large temperature change or drop... you can obtain *temperature approaches of 5° to 10° F.*

TRANE Brazed Aluminum heat exchange surface makes it not only possible—but *practical!* That's because the new TRANE Brazed Aluminum packs up to 450 square feet of surface into a single cubic foot of space.

This huge amount of surface in a single unit makes maximum use of available pressure drop. And you don't lose pressure through connections.

TRANE Brazed Aluminum can handle heat transfer between three, four, five or more streams simultaneously—liquid to liquid, liquid to gas, or gas to gas. Temperatures from 500° F. to -300° F. Tested at pressures up to 1000 Psig.

Want more information? Contact your nearest TRANE sales office, or write The TRANE Company, LaCrosse, Wis.



WHAT IS BRAZED ALUMINUM? A stack of flat plates and corrugated fins in layers, all brazed in perfect bond. Strong, light, compact and completely flexible. Illustration below shows strong fillet formed between fin and plate.

TRANE

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Eastern Mfg. Division, Scranton, Pa.

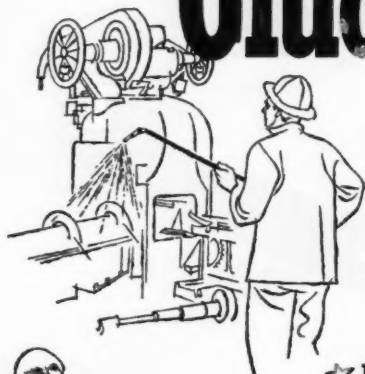
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Offices in 80 U.S. and 14 Canadian Cities

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AIR CONDITIONING AND HEAT TRANSFER EQUIPMENT

What Properties in an Acid Do You Need Most?

Gluconic Acid is



★ Non-corrosive!

Extensive laboratory tests have shown Gluconic to be the least corrosive of the mild acids.

★ Non-toxic!

Other tests have demonstrated this acid's non-toxicity. It is widely used in pharmaceutical preparations.



★ An Effective Sequestering Agent!

Inactivates metallic contaminants. Keeps trace metals from precipitating out of solution.

These properties explain why Gluconic is a versatile acid. It is used widely as an ingredient of cleaning compounds, particularly those used for food and beverage equipment, and is effective in beerstone prevention. It is used in the textile industry as an acid catalyst for vat soluble ester printing pastes and as a sequestering agent to give sharper prints in dyeing operations. It is also used as a sequestering agent in tanning and in industrial water treatment.

Gluconic acid may be the mild, non-toxic acid you have been looking for. It may help improve your present processing operations or suggest new ones. Additional information is contained in Technical Bulletins Nos. 29 and 33. Write:

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Manufacturing Chemists

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Chemical Industry Pauses for a Shakedown

The chemical industry is in the midst of a shakedown period. Most industry leaders agree that it's temporary. But the fact persists that—right now—they're concerned about demand.

When you consider the incredible pace of chemical expansion since the war it's hard to believe that the industry hasn't stopped for a "breather" long before this.

► **The Rapid Climb**—In the six years from 1946 to 1951 chemical outlay for new plants and equipment—\$5.4 billion—exceeded the value of the industry's gross capital assets at the end of 1945. That total comes to more than 11 percent of the \$48.1 billion invested by all manufacturing industry.

From 1946 to 1951 the book value of chemical company assets rose by 129 percent. This compares with a figure of 92 percent for all industry.

Industry leader Du Pont has alone plunked down \$700 million for new plants and equipment since the war. Second ranking, saleswise, Union Carbide & Carbon has spent around \$550 million.

And seven other big firms—Allied Chemical & Dye, American Cyanamid, Dow Chemical, Monsanto Chemical, Eastman Kodak, American Viscose and Celanese—have spent over \$100 million each.

► **Capacity Up**—Here's the record in terms of additions to capacity. The index of capacity for chemicals that stood at 100 in 1939 and 172 in January 1946 has risen to more than 325. The index of all manufacturing went from 100 in 1939 to 131 in January and now stands at 190.

Last year alone, facilities for turning out such key chemicals as benzene, styrene for plastics and DDT insecticide climbed 30 per cent above the previous year. And there's more capacity in the works.

Despite the present sales lull, various checkups among industry leaders failed to disclose a single instance where a large or middle-sized firm has announced final cancellation of any contract for additional capacity.

Another way to spell out the dizzy

climb in chemical capacity: During the past quarter of a century the average rate of growth of the chemical industry has been about 10 percent a year compared with a 3 percent average for all U.S. industry.

► **Now the Pause**—Chemical sales are now running at a rate 10 percent under the March quarter. Management officials are concerned about demand prospects for the balance of the year.

It's not just a question of the hectic expansion of the postwar years. A key factor in the present softening of demand is the fact that the end of constantly increased federal spending is in sight.

Defense expenditures will continue to mount for several months, but the mobilization program has made such progress that businessmen are beginning to look over the hump and into the valley. And, of course, the recent sluggishness in consumer spending has acted as a brake on industrial output.

A temporary—but not unimportant—factor making for slack industrial demand is the shortage of steel brought on by the prolonged strike. The summer doldrums are accentuated as more and more plants follow the policy of shutting down for two weeks while employees go on vacation.

► **Prices Slashed**—A sign of the times is the flurry of price cutting. Two important solvents used in making automobile lacquers—butyl alcohol and butyl acetate—have come down a cent a pound to 14.5¢.

Other chemicals used in plastics processing have come down somewhat. One phthalate plasticizer fell from 40¢ to 37¢ a pound; octyl alcohol from 29¢ to 26.25¢.

Industrial alcohol was bringing 93¢ a gallon early this year. The going price is now less than 55¢.

Alkalis, including caustic soda used in making rayon and soda ash which goes into glass, are getting progressively easier. It wasn't many months ago that these items commanded premium prices in the black market.

► **Antibiotics Hit**—The short-term business outlook for drug manufacturers, too, has lost some of its luster.

The huge inventory pileup of penicillin and streptomycin—the two big bulk antibiotic products of the industry—precipitated a price war. Prices have been slashed to almost half of last year's level. And profit margins are fading away to the vanishing point.

Increased efficiency in producing antibiotics plus a sizable expansion program brought an upward spiraling of supply. Drug factories abroad—in Europe and Asia—cut into U.S. export markets. And here at home many doctors are becoming increasingly cautious when it comes to prescribing antibiotics for minor ailments.

Even the recently announced anti-TB drugs have come down in price as much as 50 percent. These drugs are already being produced by a dozen or so manufacturers. And other companies are expected to jump into the field shortly.

► **Long-Run Outlook**—If you take the long view, the outlook is far rosier.

So far as the drug market is concerned, it's a cinch that many additional uses will be developed. And

Capital Expenditures (1946-51) as Percent of Capital Assets (1945).

	1945 (Billions)	1946-51 (Percent)
Chemicals & allied products.....	\$4.2	129
Transportation equipment, incl. autos.....	3.7	124
Textile mill products.....	2.7	111
Nonelectrical machinery.....	3.6	108
Nondurable goods.....	29.1	97
All manufacturing.....	52.1	92

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In hundreds of industries where processing operations require constant and accurate temperature—DOWTHERM® has proved invaluable in providing and controlling the required heat at low pressure.

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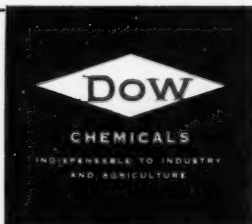
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ECONOMICS, cont. . .

in the area of public health there are plenty of fields left to conquer. Cancer and polio are still resisting the onslaught of the newest drugs. And then, of course, there's still the common cold.

The chemical outlook should begin to brighten by September when the fall pickup starts. Plastic manufacturers, for example, are confident that the preparations for holiday trade will bring better business.

Plastics offer a good illustration of the long-range optimism shared by chemical officials. Plastics are a major chemical product as well as a major consumer of basic chemicals.

The industry expects a doubling of plastic output—to more than 4.5 billion pounds—by 1955. The size of the objects that can be molded is steadily increasing. Not long ago most molded plastics were mere gadgets. But TV cabinets and refrigerator door liners are but two of the large objects that can now be molded.

And the industry still has untapped markets. Linoleum floor covering made of vinyl plastics is a pretty sure bet. It wears three times as long as the old type of linoleum and the price is competitive.

Vinyl plastic tie pads for use under the steel plates on railroad ties are just coming into use. The plastic pads reduce wear on the ties. You can get an idea of the potential market when you realize that there are over a billion ties in American track. And 40 million new ones are installed yearly.

Styrene plastic output is running at about five times the 1946 production. But there are still big new fields ahead. Styrene will find increasing use in light-weight rigid pipe. Brush bristles offer another large market potential. And styrene is used in the production of some new fast-drying paints.

Perhaps the fastest growing plastic is polyethylene. This is used in the production of the squeezable dispensers now so popular. Over the next two years it is planned to quadruple output up to 250 million pounds a year.

But plastics are no isolated example. To sum it up: confidence, faith and optimism still characterize the chemical industry's thinking about its long-term economic future.

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STURTEVANT
DEVELOPMENT!*

IMPROVED INDUSTRIAL HEATER for heating large plant areas



**Two new Industrial Heaters
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for manufacturing areas, warehouses, garages, commercial buildings — with standard heating coils.

HEAVY DUTY HEATER

for continuous-duty high-pressure systems, or industrial process work — with wrought iron heating coils.

EXCLUSIVE STURTEVANT FEATURES

HEAVY DUTY HEATERS—For rugged service, wrought iron 1" pipe is used instead of copper tubing. Tapered steel fins are metallically bonded to the pipe. Solder bath provides permanent bonding and corrosion-resisting external coating. Internal steam distributing pipes are also wrought iron, protect against freezing. *The entire coil assembly is as rugged as the connecting steam lines.*

SMOOTH EXTERIORS—Die-formed casings with rounded corners eliminate accident-causing sharp edges and dirt-catching pockets. Removable panels aid inspection.

ONE WARRANTY—Only Westinghouse makes all principal components—fans, heating coils and motors. You get unit engineering and single equipment responsibility.

Other features are:

WIDE RANGE OF SIZES—Heat output up to 2,500,000 btu/hr; air volumes up to 25,000 cfm; steam pressures up to 200 psig. **ACCESSORIES**—Filter boxes optional for mechanical air cleaning. Mixing boxes optional for proportioning outside and re-circulated air.

For more information, contact your nearest Westinghouse Sturtevant office. Or write for Catalog 1510, soon off the press. Address Westinghouse Electric Corp., Sturtevant Division, Hyde Park, Boston 36, Mass.

YOU CAN BE SURE...IF IT'S Westinghouse

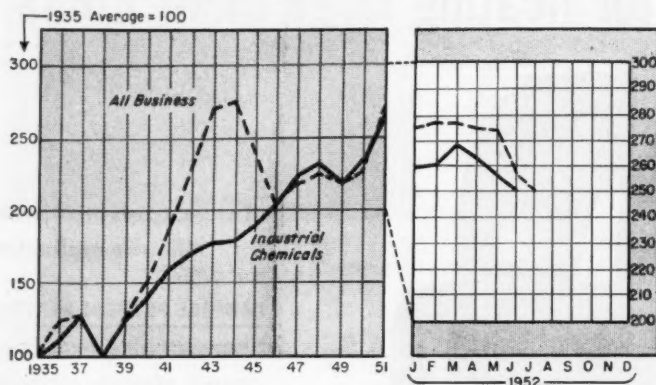
TUNE IN ON HISTORY! Only Westinghouse brings you complete coverage of political campaign over CBS television and radio.

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Process Industry Trends

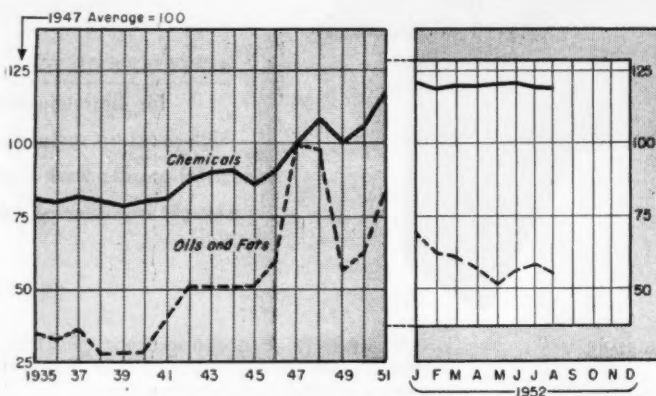
CONSUMPTION



Industrial Chemicals Index

	June (Est.)	May (Prelim.)	April (Revised)
INDEX	252.00	257.43	263.19
Fertilizers.....		65.06	68.34
Pulp and paper.....	26.84	29.14	28.90
Petroleum refining.....	26.46	16.58	22.11
Iron and steel.....	3.01	15.16	14.64
Rayon.....	25.72	23.42	22.64
Glass.....		23.20	21.90
Paint and varnish.....		30.49	29.98
Textiles.....		9.87	9.94
Coal products.....		9.70	10.13
Leather.....		4.06	4.06
Explosives.....		9.07	8.92
Rubber.....	5.85	5.91	6.05
Plastics.....		15.57	15.58

PRICES

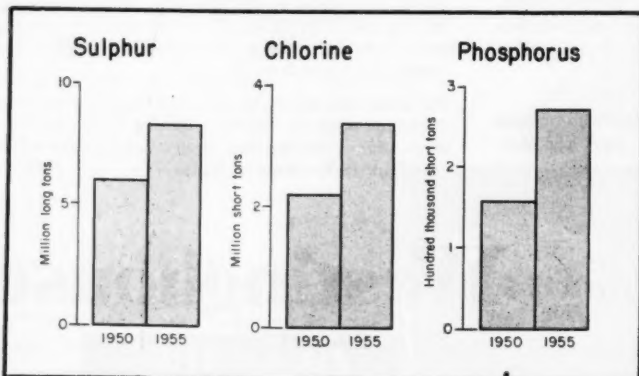


Chemical Engineering's Price Indexes

Chemicals DOWN -0.04%
Oils and Fats DOWN -4.4%

	Chemicals	Oils & Fats
As of August 1, 1952.....	119.57	55.30
Last month.....	119.62	57.85
August, 1951.....	119.35	76.49
August, 1950.....	103.27	62.33

HIGHLIGHT OF THE MONTH



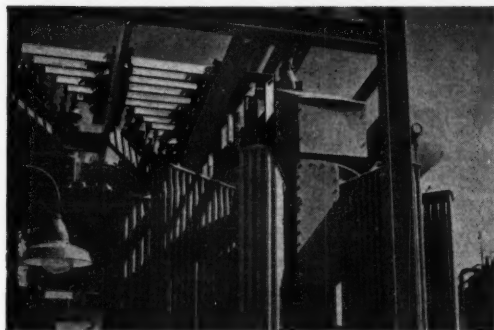
Three 1955 Expansion Goals

Sulphur output is expected to reach 8.4 million tons in 1955. This is a 27 percent increase over the year DPA set up our goals—1950.

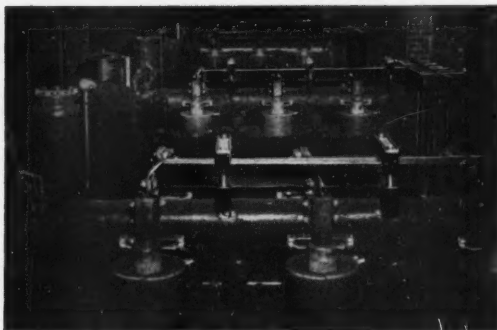
By 1955, chlorine productive capacity is scheduled to be increased 37 percent over 1950 levels. Over this period, actual chlorine capacity is to be upped 1.2 million short tons to a total of 3.4 million tons.

Goal for phosphorous output capacity is 270,000 short tons by 1955. This indicates an increase of 114,000 tons more than capacity at the end of 1950.

It takes a **Lot** of Copper to make a Lot of Chemicals!



These photographs show a lot of copper bus bar in a new plant of a great chemical company, whose name and location cannot be disclosed. The copper carries heavy currents to electro-chemical equipment for the production of valuable products used in national defense and in industry. Revere furnished 325,000 pounds of bus bar for this service, the bar going into substations, rectifier stations, and cell houses. In addition, at the time of installation the Revere Technical Advisory Service collaborated with the customer in working out some difficult details in the design of switches. If you need electrical conductors, remember that copper has the highest electrical conductivity of all the commercial metals, that Revere makes bus bar, and that the Revere



Technical Advisory Service is always ready to work with you on any problem concerning copper and its alloys or aluminum alloys. Call the nearest Revere Sales Office.

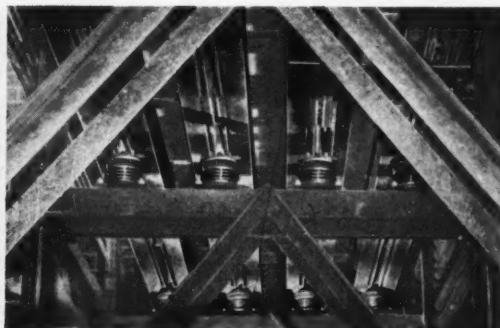
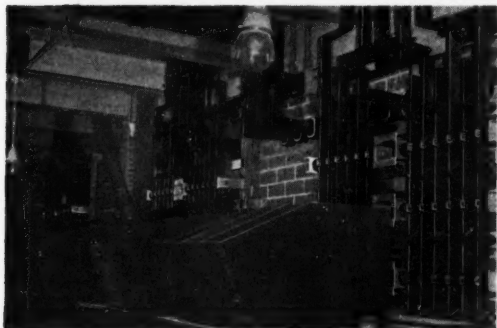
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New Construction

Proposed Work

Fla., Panama City—International Paper Co., Panama City, plans to construct plant additions. Estimated cost \$1,300,000

N. C., Draper—Union Carbide & Carbon Chemicals Co., 30 East 42nd St., New York, N. Y., plans to construct a synthetic fiber plant to manufacture Dynel near here. Estimated cost \$30,000,000

N. C., Morganton—Great Lakes Carbon Corp., Morganton, plans to construct plant additions. Estimated cost \$4,500,000

O., Chillicothe—Mead Corp., 8th and Mulberry Sts., plans to construct a paper finishing plant and warehouse. Estimated cost \$2,500,000

Okla., Pryor—Deere & Co., Moline, Ill., 1325 Third Ave., plans to construct a urea chemical and fertilizer plant here. Estimated cost \$20,000,000

S. C., Georgetown—International Paper Co., Georgetown, plans to construct plant additions. Estimated cost \$2,000,000

Tex., Baytown—Humble Oil & Refining Co., Baytown, plans to construct propane de-asphalting plant and storage plant. Estimated cost \$5,500,000

Tex., Corpus Christi—Sunlute Refining Co., First Natl. Bank Bldg., Tulsa, Okla., plans to construct a 25,000 bbl. capacity refinery, also gasoline and products storage farm. Estimated cost \$14,000,000 and \$550,000 respectively

Tex., Freeport—Dow Chemical Co., Freeport, plans to construct an Ethylene plant. Estimated cost \$6,675,000

Utah, Garfield—American Smelting & Refining Co., Garfield Chemical & Manufacturing Co., and Stauffer Chemical Co., Pacific Natl. Life Bldg., Salt Lake City, Utah, plan to construct a fertilizer plant here. Estimated cost \$5,000,000

Va., Norfolk—Esso Standard Oil Co., 8201 Hampton Blvd., plans to construct an oil refinery. Estimated cost \$50,000,000

Contracts Awarded

Ark., Pine Bluff—Diamond Alkali Co., Pine Bluff, will construct a plant with own forces. Estimated cost \$300,000

Calif., East Los Angeles—Bradley Paint Co., 4070 East Washington Blvd., has awarded the contract for a steel storage building to Empire Steel Buildings Co., 2137 Marianna Ave., Los Angeles. Estimated cost \$96,000

Ga., Atlanta—Norwich Pharmaceutical Co., 710 Lee St., S. W., has awarded the contract for a warehouse to Consolidated Realty Co., 32 Pryor St., N. E. Estimated cost \$250,000.

Ill., Des Plaines—Universal Oil Products Co., 310 South Michigan Ave., Chicago, Ill., has awarded the contract for a pilot research plant to Henry Ericsson Co., 228 North La Salle St., Chicago. Estimated cost \$200,000

Ind., Gas City—Midwest Glass Co. (Knox Glass Associates, owners), Gas City, will construct a glass factory with own forces.

	Current Projects		Cumulative 1953	
	Proposed Work	Contracts	Proposed Work	Contracts
New England.....		\$200,000	\$7,000,000	\$2,892,000
Middle Atlantic.....		2,736,000	43,450,000	42,716,000
South.....	\$87,800,000	4,137,000	382,768,000	301,089,000
Middle West.....	2,500,000	9,080,000	69,830,000	113,822,000
West of Missisippi.....	46,725,000	10,454,000	547,588,000	358,667,000
Far West.....	5,000,000	96,000	14,728,000	25,688,000
Canada.....			162,833,000	43,868,000
Total.....	\$148,025,000	\$26,673,000	\$1,199,194,000	\$788,223,000

J. H. Nogar, Supt. Constr. Estimated cost \$400,000

Ky., Paducah—U. S. Atomic Energy Comm., 1901 Constitution Ave., N.W., Wash. 25, D. C., has awarded contract for addition to uranium separation plant to F. H. McGraw & Co., 780 Windsor St., Hartford, Conn. Carbide & Carbon Chemicals Co., Div. of Union Carbide & Carbon Corp. will operate plant. Estimated cost \$459,000,000

Mass., Andover—Tyler Rubber Co., Railroad St., has awarded the contract for a rubber factory to F. Leroy Fox, Inc., 88 Broad St., Boston. Estimated cost \$100,000.

Mass., Springfield—Monsanto Chemical Co., 812 Monsanto Ave., has awarded the contract for an addition to Bldg. No. 51 to Ley Construction Co., 124 State St., Boston. Estimated cost \$100,000

Mich., Sandusky—Yale Rubber Co., Sandusky, will construct a 1 story, 60x700 ft. plant with own forces. Estimated cost \$200,000

Minn., St. Paul—Minnesota Mining & Manufacturing Co., 900 Faquier Ave., has awarded the contract for a factory and warehouse at East 7th St. and Faquier Ave., to W. Murphy & Sons, 416 New York Bldg. Estimated cost \$3,000,000

N. J., Paulsboro—Sicony-Vacuum Oil Co., Inc., 26 Bway., New York, N. Y., has awarded the contract for a catalyst manufacturing plant to Bechtel Corp., 151 East 42nd St., New York, N. Y. Estimated cost \$2,500,000

N. C., Charlotte—Goodyear Tire & Rubber Co., Inc., 209 East 7th St., has awarded the contract for a warehouse and office to South-eastern Construction Co., 301 West 7th St. Estimated cost \$275,000

O., Toledo—Sun Oil Co., 1608 Walnut St., Philadelphia, Pa., has awarded the contract for a catalytic naphtha reformer for making high octane gasoline to have a capacity of 10,000 bbl. daily, to Procon, Inc., 75 East Jackson St., Chicago, Ill. Estimated cost between \$3,500,000 and \$4,000,000

Pa., Corry—Corry-Jamestown Corp., Corry, has awarded the contract for a chemical neutralizer plant to Henry Shenk Co., 115 Sassafras St., Erie. Estimated cost \$150,000

Pa., Philadelphia—American Aniline & Extract Co., Venango and F Sts., has awarded the contract for a laboratory and office to William F. Lotz, Adams Ave. and Orthodox Sts. Estimated cost \$86,000

S. C., Rock Hill—Celanese Corp. of America, Rock Hill, has awarded the contract for alterations to Celriver plant to Daniel Construction Co., 429 Main St., Greenville. Estimated cost \$500,000

Tenn., Chattanooga—B. F. Goodrich Co., c/o Wm. J. Funk, Engr., Dome Bldg., has awarded the contract for a warehouse and

office to J. W. B. Lindsey, 401 North Market St., at \$111,674

Tenn., Oak Ridge—U. S. Atomic Energy Comm., 1901 Constitution Ave., N.W., Wash. 25, D. C., has awarded contract for atomic diffusion plant addition to F. Maxon Construction Co., 131 N. Ludlow St., Dayton, O. Plant will be operated by Carbide & Carbon Chemicals Co., Div. of Union Carbide & Carbon Corp. Estimated cost \$464,000,000

Tex., Conroe—Columbian Carbon Co., Conroe, will construct a bag collector system at its plant with own forces. Estimated cost \$465,000

Tex., Corpus Christi—Columbia-Southern Chemical Corp., Box 4026, has awarded the contract for enlarging its laboratory to Burnett Construction Co., Box 336. Total estimated cost \$519,112

Tex., Houston—Gulf Portland Cement Co. Penn City Rd., has awarded the contract for enlarging its cement plant to R. F. Ball Construction Co., 3200 West Dallas St. Estimated cost \$465,000

Tex., Longview—Humble Oil & Refining Co., 128 West Tyler St., has awarded the contract for Unit 1 of bulk gasoline plant to Canterbury Engineering & Construction Co., Box 1494, Kilgore. Estimated cost \$110,000

Tex., Longview—Skelly Oil Co., Longview, will reconstruct its refinery distilling tower. Work will be done by day labor and sub-contracts. Estimated cost \$285,000

Tex., Midland—O. C. Pennell, Midland, will construct additional batching bin and conveyor for cement plant with own forces. Estimated cost \$85,000

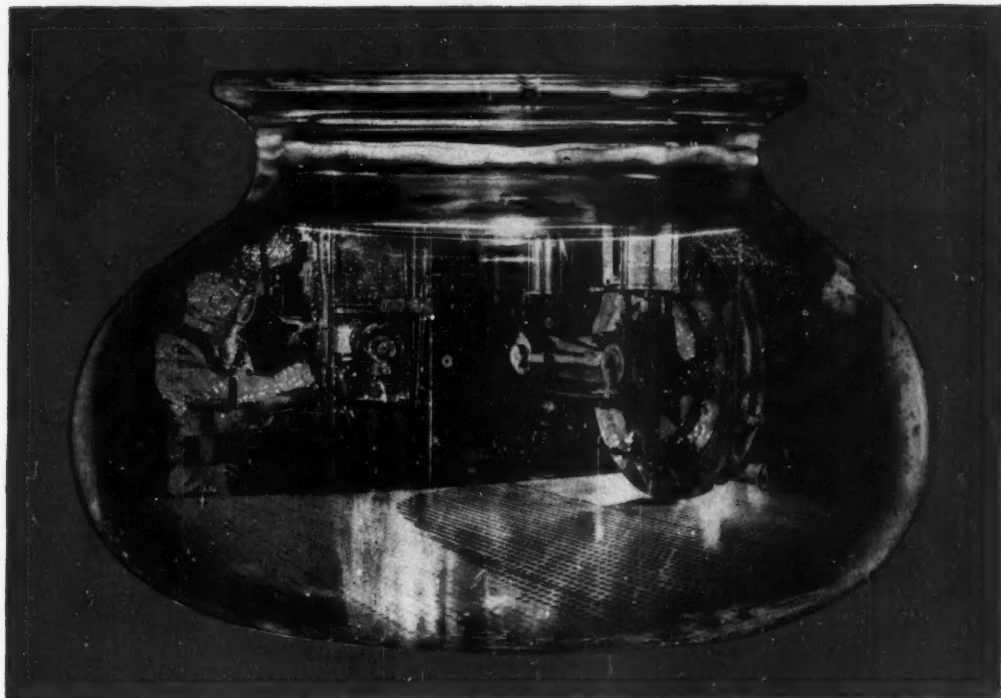
Tex., Odessa—Stanolind Oil & Gas Co., Odessa, will construct sulfur recovery plant with own forces. Estimated cost \$1,250,000

Tex., Port Neches—Jefferson Chemical Co., Port Neches, has awarded the contract for a glycol plant unit, also chemical plants units No. 2 and 3, to C. F. Braun & Co., 1000 South Fremont St., Alhambra, Calif. Estimated cost \$850,000, \$400,000 and \$375,000 respectively

Tex., Texas City—Texas City Refining, Inc., Texas City, has awarded the contract for a 19,000 bbl. capacity Houdrflow catalytic cracking unit, also 350 ft. cracking tower, to Kaiser Engineers, 1924 Bway., Oakland, Calif. Estimated cost \$2,350,000

Va., Richmond—Manchester Board & Paper Co., Canal near Hall St., has awarded the contract for a paperboard plant to Doyle & Russell, Central Natl. Bank Bldg., Richmond. Estimated cost \$3,000,000

Wis., Marinette—Marinette Paper Co., Marinette, has awarded the contract for a paper converting plant to Edw. H. Meyer Construction Co., Neenah, Wis. Estimated cost \$750,000



Instantaneous water quenching of spot-welds, bonding stainless liners to carbon steel plate, is just as effective as though it were done submerged in a fish bowl!

Resistance welding under water preserves corrosion properties of stainless liner in SMITHlined vessels

An exclusive A. O. Smith technique makes sure that stainless lining spot welded to carbon steel plate, retains its original corrosion-resistant properties in process equipment.

Closely and precisely spaced spot-welds that inseparably bond the liner to the load-bearing vessel walls are instantly quenched in water at the time of welding. The interval of critical temperature is so short that preferential attack is avoided.

The automatic equipment employed in this operation is A. O. Smith designed and built. Simulta-

neously, it joins liner to base under great hydraulic pressure, applies the welding current and floods the spot with quenching water.

No wonder SMITHlined pressure vessels have records of more than twenty years in corrosive service without failure.

For assurance of superiority in vessel design and construction, and for aid in solving vessel application problems, call on A. O. Smith where the industry's leading laboratory, design and engineering groups are at your service.

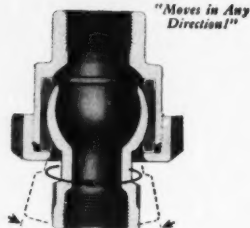
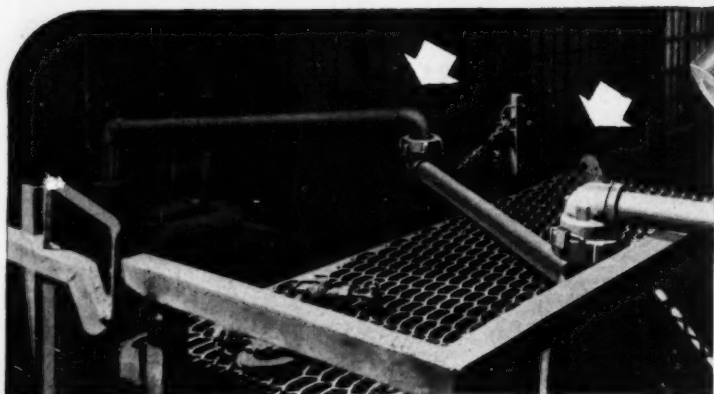


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BARCO *Flexible Ball Joints*



When you need movable joints in piping handling **SULFURIC ACID**

THE BARCO BALL JOINT is one of the most useful, most versatile fittings ever developed to provide *flexibility* in piping. The above photograph shows two stainless steel Barco Ball Joints used in making an extension type unloading line for sulfuric acid at a steel mill. This is but one of many installations in industry where Barco joints are used in handling corrosive acids, alkalies, solvents, steam, oil, air, gas, water, and practically all other fluids, including white fuming nitric acid.

BARCO BALL JOINTS offer many advantages over ordinary types of joints or flexible connections. The Barco design allows for movement in "any direction"—360° rotation plus 30° to 40° flexing. *Thus, one Barco ball joint will often do the work of two or more ordinary swivel joints at lower cost and with less maintenance.* When you want to be sure of getting SAFE, long-lasting, trouble-free installations, specify BARCO! Ask our engineers for recommendations. *Worldwide Sales and Service.*

BARCO MANUFACTURING CO., 1816J Winnemac Avenue, Chicago 40, Illinois. In Canada: The Holden Co., Ltd., Montreal.

1. NO METAL-TO-METAL CONTACT BETWEEN MOVING PARTS. An important Barco advantage where corrosive chemicals are present, either externally or internally.

2. CHEMICALLY INERT GASKETS. Barco offers a choice of seven types of gaskets including No. 11-CT for corrosive service. No lubrication required.

3. STAINLESS STEEL BODIES. Also regularly furnished in Malleable Iron, Steel, Bronze, and Aluminum. Other special alloy joints to order.

4. MAXIMUM FLEXIBILITY. Up to 40° side flexibility with 360° rotating movement.

5. PRESSURE SAFE! FIRE-PROOF! Unequaled for SAFETY where flexible connections are required.

6. MANY STYLES AVAILABLE. Angle or straight; threaded or flanged connections. For pressures to 7,500 psi; temperatures to 1000°F. 15 different sizes. 1/4" to 12".

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BARCO

THE ONLY TRULY COMPLETE LINE OF FLEXIBLE
BALL, SWIVEL, SWING, AND REVOLVING JOINTS



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because it
OFFERS MORE



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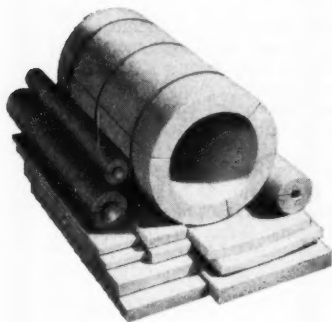
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Kaylo Heat Insulation offers an outstanding combination of advantages—in both performance and application.

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Kaylo Heat Insulation is hydrous calcium silicate, *not glass*. It is insoluble in water, incombustible and exceptionally lightweight—yet strong. Breakage is almost negligible. Easily cut and fitted, it is installed with standard tools.

You'll find that your jobs can be done better with Kaylo Heat Insulation. Get all the facts about its advantages.



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KAYLO . . . *first in calcium silicate*

... pioneered by OWENS  ILLINOIS Glass Company

MAIN OFFICE: TOLEDO 1, OHIO—KAYLO SALES OFFICES: ATLANTA • BOSTON • CHICAGO • CINCINNATI • CLEVELAND
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Slow leaks can be expensive



HOW SLOW ?

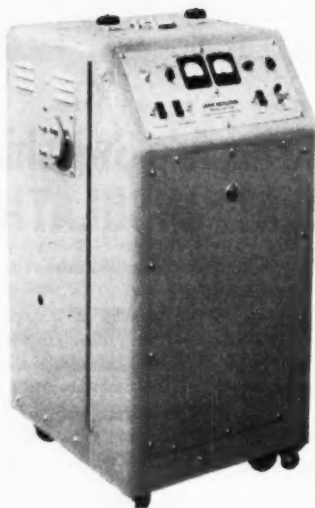
10 years 20 years 30 years

Leak Detector Model 24-101A detects, locates and measures any leak down to the almost unbelievably minute range where it would require 31 years for one cubic centimeter of gas to escape.

HOW EXPENSIVE ?

If you are working with critical processes or equipment such as hermetically sealed instruments or glass-to-metal seals required in television camera tube assembly, then you know very slow leaks can be costly. In many of these low-volume, low-pressure applications this mass spectrometer type leak detector is the only instrument sensitive enough for the job.

This instrument is also ideal for less critical work—checking industrial vacuum equipment, high pressure cylinders, compressors moving on an assembly line, valves, welded and soldered joints. Write for Bulletin CEC 1801.



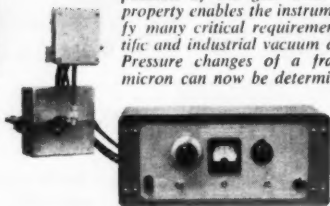
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a subsidiary with offices in: Pasadena, Philadelphia,
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for science
and industry

MICROMANOMETER, MODEL 23-105 provides precise absolute pressure measurements in the micron range (0.1 to 150 microns) without knowledge of the composition of the gas. This remarkable property enables the instrument to satisfy many critical requirements in scientific and industrial vacuum applications. Pressure changes of a fraction of a micron can now be determined.



THERE'S A MONARCH NOZZLE FOR EVERY SPRAY JOB

Remember—if the liquid can be sprayed with direct pressure Monarch can furnish the Nozzles.

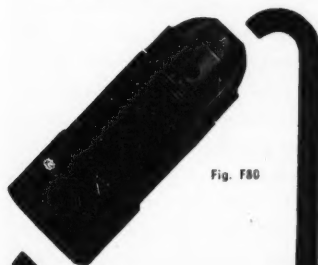


Fig. F80

**In many industries
Monarch Spray
Nozzles are used for:**
ACID CHAMBERS
AIR WASHING
CHEMICAL
PROCESSING
COOLING PONDS
DESUPERHEATING
GAS SCRUBBING
HUMIDIFYING
OIL BURNERS
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Sent on Request

Monarch Mfg. Wks., Inc.
2513 E. ONTARIO STREET
PHILADELPHIA 34, PA.



approximately 20x

**Filament
or
Spun Yarn**

Here's a list of our synthetic filter cloths and the kind of yarn from which they are manufactured:

Cloth	Filament	Spun
Nylon	Yes	Yes
Orlon*	Yes	Yes
Dynel	No	Yes
Vinyon-N†	Yes	No
Vincel**	Yes	No
Glass	No	Yes
Saran	Yes	No

Note: Fabrics of blended filament and spun yarns are also available in several of these fibers.

Filament yarn fabrics by their very nature are smooth surfaced, affording exceptional tensile strength, high capacity and clean discharge. At times, however, they may not give desired clarity of filtrate or the resilience necessary for proper sealing. In such instances, a spun yarn fabric can excel because its fibrous surface aids in the entrapment of fine particles. In addition, a spun yarn creates a bulkier compressible cloth. Blended fabrics are designed to offer a maximum of strength with a higher degree of retention as well. Experience will tell you which is the controlling factor when ordering cloth; or, if you would like, we'll be glad to supply comparative samples.

Consider the value to you of our two-way service in connection with filter cloths: a wide variety of synthetic yarn cloths, in addition to our cotton cloth, which have many desirable characteristics for handling chemicals, hot and cold; and a selection of yarn or combination of yarns to best fit your filtering requirements.

Remember, we have at our New Haven and Salt Lake City factories, facilities for making up elements for any type of filter in all the available fibers.



Weavers of Industrial Filter Media for over Forty Years

The National Filter Media Corp.

General Offices & Mills: New Haven 14, Conn.
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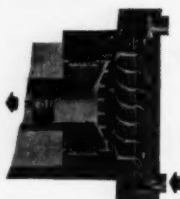
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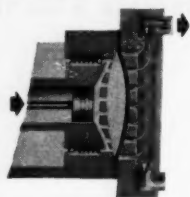
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1406 Second National Bank Bldg.

Oils, Norway
Nicolai Friis

Johannesburg *South Africa
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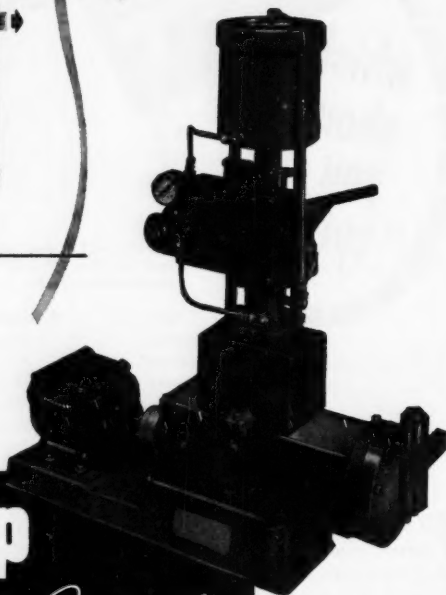


INTAKE STROKE



DISCHARGE STROKE

No Contamination
... and **Positive**
control of
pumping volume



Lapp *Auto-Pneumatic* **PULSAFEEDER**

Reciprocating piston action provides positive displacement. But piston pumps only a hydraulic medium. Diaphragm does no mechanical work—acts only as floating, balanced partition, isolates chemical being pumped from working pump parts—eliminates need for stuffing box or running seal. Pumping speed constant—volume variation results from variation in piston-stroke length. In Auto-Pneumatic models, pumping rate precisely controlled by instrument air pressure responding to any instrument-measurable processing variable. The Lapp Pulsafeeder is successfully handling almost all highly corrosive and "hard-to-handle" chemicals, against pressures up to 2,000 lbs.

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No. 300, just issued. 24 pages of description, specifications, typical applications, flow charts. Inquiry Data Sheet included from which we can make specific engineering recommendation for your processing requirement. Write Lapp Insulator Co., Inc., Process Equipment Division, 543 Maple Street, Le Roy, N. Y.



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efficient*

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HERE'S HOW RIETZ HELPS!

If you are responsible for size reduction—crushing, grinding, pulverizing, pulping, pureeing, shredding—and you want data on the most efficient methods available, write our laboratory, describing conditions and results required, with samples of your base material. We'll test it for you, compare it with similar tests, and make a full report.

Rietz **SIZE REDUCTION EQUIPMENT:**

DISINTEGRATORS PREBREAKERS BLOCKBUSTERS

*Equipment for the
food and chemical
process industries*

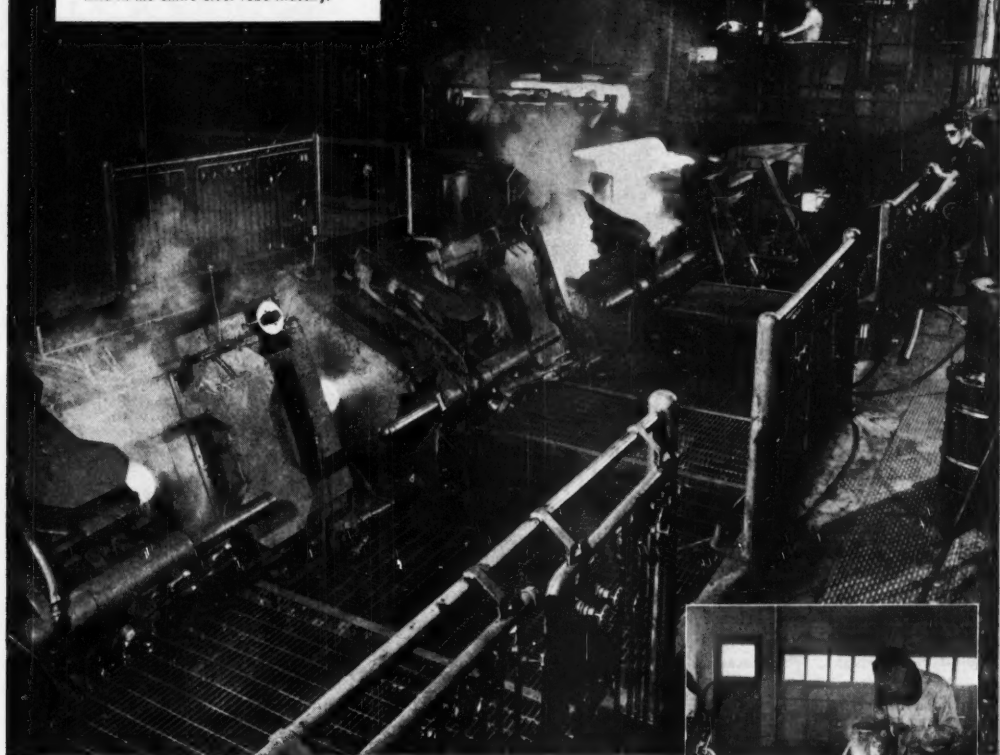


MANUFACTURING CO.

Santa Rosa, California

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The finest welding fittings available are made from seamless steel tubes forged in Globe's Foren Mill . . . the only one of its kind in the entire Steel Tube Industry.



NOW...get immediate delivery on **GLOBE** welding fittings...

**the only seamless welding fittings precision
processed from billet...to tube...to fitting**

NOW — you can schedule immediate delivery on the finest welding fittings made today. Globe fittings — the only fittings manufactured through a continuous precision process that begins with the making of the seamless tube and continues through to the production of finished fittings.

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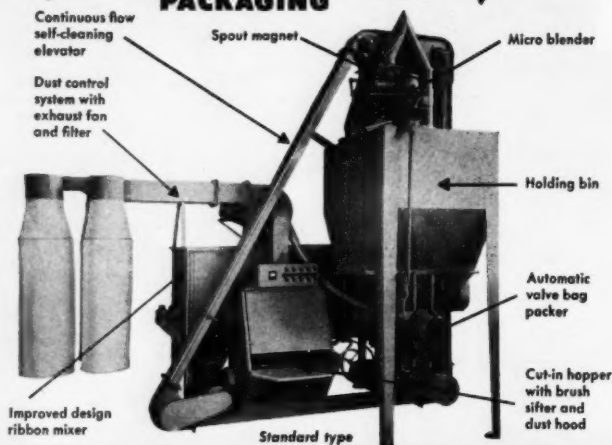
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available anywhere,
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Ready To Run U.S. PATENT NO. 2,591,721

For formulating Insecticides (Dusts and Liquids) ... Industrial Chemicals ... Prepared Flour Mixes ... Pharmaceuticals ... Water Paints ... Soap Powders ... and many other materials.

These moderately priced plants have demonstrated conclusively their ability to greatly increase the production of innumerable products while substantially lowering labor and other production costs. Maximum production per dollar invested is provided by this "Ready To Run" equipment. Thorough factory-testing before shipment assures efficient performance.

Minimum Space Required ... "R. T. R." Uni-Blender Compounding Plant, Standard Type, requires only 9' x 12' of floor space, 13' of headroom. No need for expensive new building or remodeling.

Available in a wide range of production capacities.

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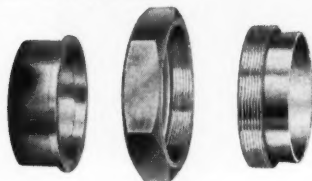
DARNELL CORP., LTD.
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These new fittings reduce piping costs by 10% to 40%



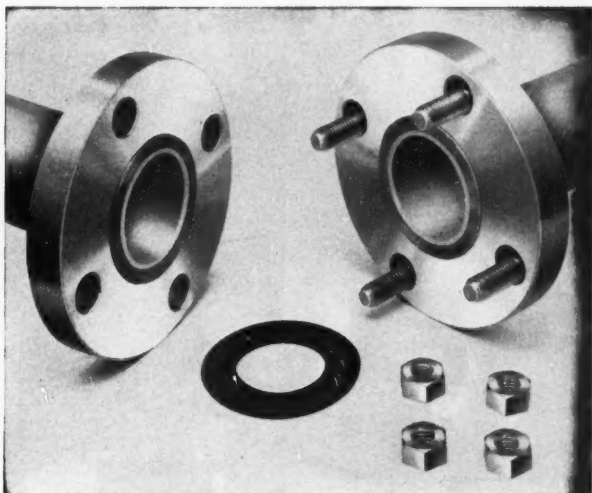
Speedline aligning connector

Joins pipe schedules 5, 10 and 40 and is also made for tubing.



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Combines best features of screwed pipe and sanitary unions; eliminates leakage encountered with ground joint type fittings.



Speedline insert flange

Corrosion-resistant serrated insert in a carbon steel flange. Only tools needed for assembly are a standard expander and open end wrench.

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First cost of *Speedline* Fittings is less than you're used to paying for fittings. And your savings in costs for pipe, valves, etc. are tremendous. *Speedline* elbows, tees, reducers, etc. are specially designed to simplify installation. These fittings will also reduce installation time, saving you still more on your piping work.

The *Speedline* Fittings book gives you the complete story—savings combined with strong, safe process piping layouts. We'll be glad to send you a copy.

Speedline **Corrosion-Resistant FITTINGS**
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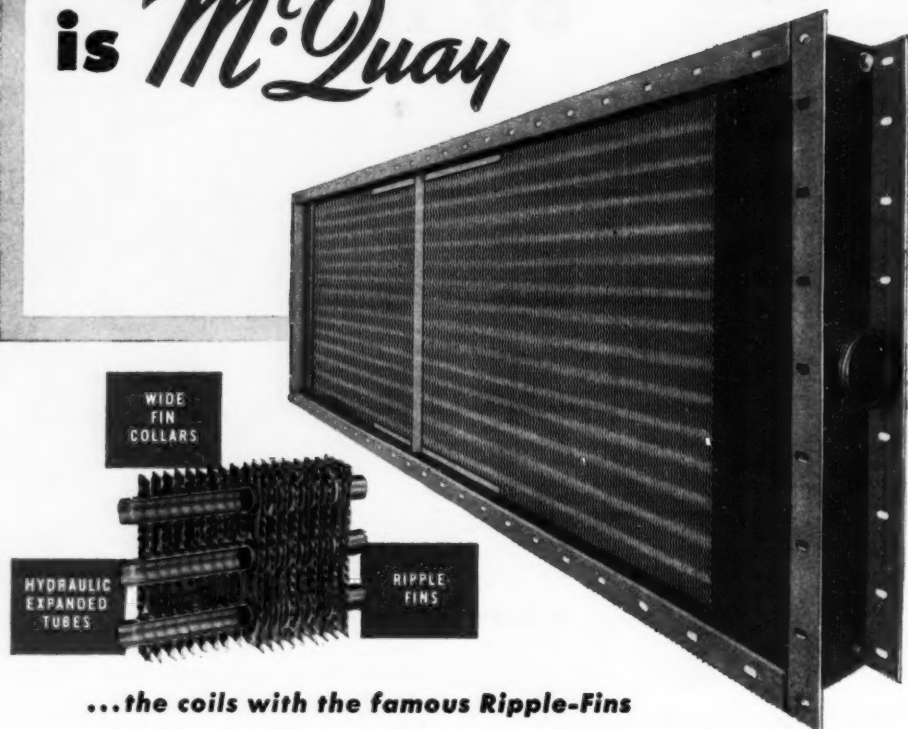
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CHEMICAL ENGINEERING—August 1952

365

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...the coils with the famous Ripple-Fins

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McQuay heating (blast) coils are available in a wide variety of styles and sizes. Hot water, cold water, brine, direct expansion, and refrigerant condensing coils are available for practically every type of application. Write McQuay Inc., 1622 Broadway St., N.E., Minneapolis 13, Minn. Representatives in principal cities.

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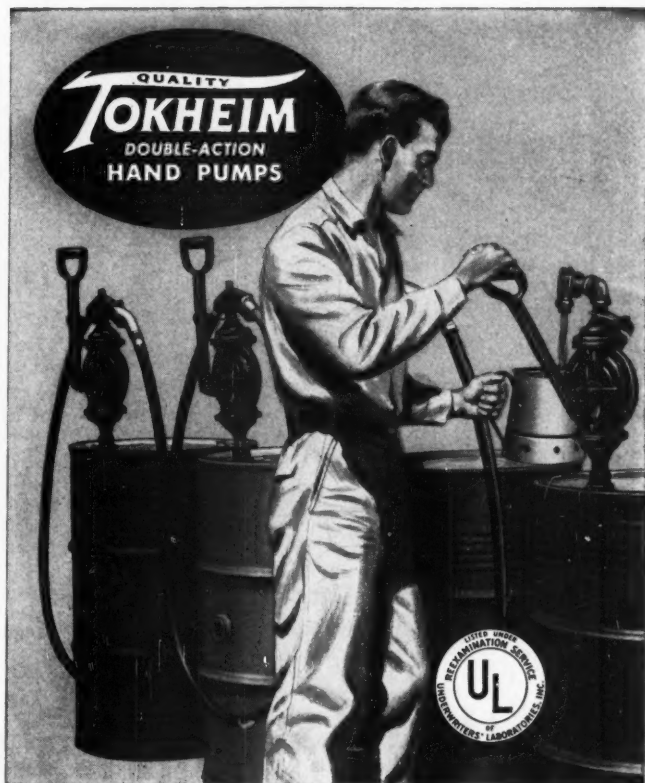
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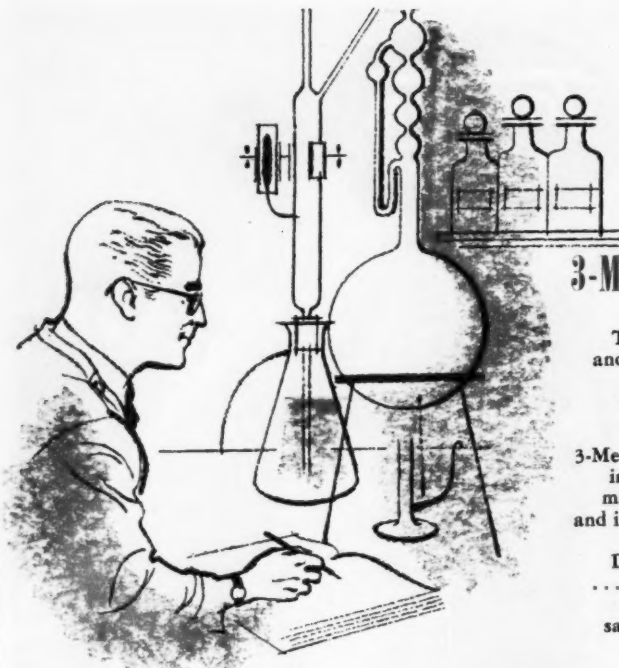
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General Products Division

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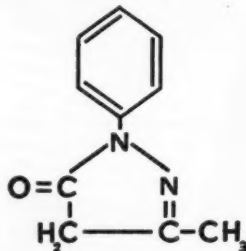
PROPERTIES

White to slightly yellow powder

Melting point (Meniscus) 128.9°C.

Molecular weight 174.2

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Thermo Electric Thermocouple and Extension Wires, in all standard calibrations, are insulated with the latest types of plastics, asbestos, or fiberglass. Fibrous insulations are compound saturated for added resistance to moisture and abrasion. For severe abrasion, metallic wire or ribbon is braided directly over outer insulation.

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CAN SAVE YOU

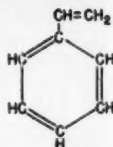
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Standard Steel Corporation offers its complete "Pilot" drying facilities to customers and prospective customers. Standard-Hersey test dryers, like the one illustrated above, can be adjusted to duplicate the performance of any rotary dryer. You learn in advance the exact requirements for your individual dryer application. This eliminates guesswork and in nearly all cases results in substantial savings in your ultimate dryer installation. Write TODAY for bulletin on "pilot" drying and the more than 30 types of Standard-Hersey dryers for the process industries.



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CHEMICAL ENGINEERING—August 1952



Commercial quantities of
KOPPERS STYRENE MONOMER
now available

Which of these reactions will solve your problem?

1. Styrene reacts with itself to give polystyrene in a great variety of molecular weights. The softening point and solubility of polystyrene can be varied within wide limits to give products to fit a variety of applications.
2. Styrene reacts with other monomers, such as isoprene, methyl acrylate, methyl methacrylate, acrylonitrile, butadiene and maleic anhydride to produce copolymers. Each of these copolymers differs in some way from pure polystyrene to give special resinous products for specific applications.
3. In its reaction with glycol maleate, styrene produces a laminating resin from which laminates of exceptional mechanical strength can be made using glass cloth or glass fiber as a filler.
4. Styrene also reacts with a variety of drying oils, such as linseed oil, tung oil, blown soybean oil, dehydrated castor oil and oiticica oil to furnish styrenated drying oils.

● Koppers Styrene Monomer is worth your consideration for use in developing new products or improving existing ones. It is a versatile raw material with many valuable applications. Styrene is supplied in tank car, tank truck and 55-gallon drum quantities.

WRITE FOR BULLETIN C-1-119



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Chemical Division, Dept. CE-82
Koppers Building, Pittsburgh 19, Pa.

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CUT HOT WATER
Costs!

Pick INSTANTANEOUS
WATER HEATERS



TO PROVIDE
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AT THE TEMPERATURE REQUIRED!

Here's the money-saving answer to hot water required for industrial needs. PICK Heaters provide hot water instantly — by steam injection. They're entirely automatic to provide

and accurately maintain temperatures up to 180° F. The exclusive Pressurizer Piston stabilizes injection pressure — eliminates pipe hammering and shaking. Available in seven sizes with rated capacities of 10 to 200 gallons per minute. Greater volumes can be obtained by multiple installations. Installation is simple, requiring only ordinary pipe connections.

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NO STORAGE TANKS NEEDED
Compact design permits installation in corners, on walls or overhead.

EASILY CLEANED
No coils. Can be cleaned in a matter of minutes — without dismantling.

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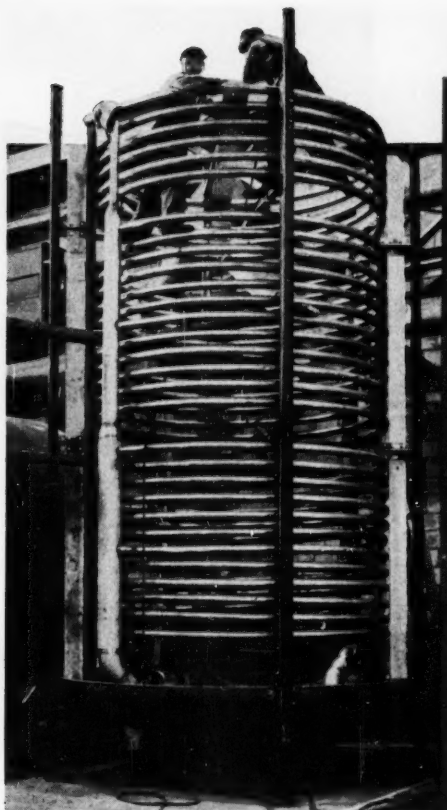
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PLUG VALVES**

DeZurik Plug Valves don't bind, can't seize . . . on any flow, an E-A-S-Y quarter-turn opens or closes them every time. They're non-lubricated, yet there's no friction and virtually no wear. . . . DeZurik's exclusive ECCENTRIC PRINCIPLE literally lifts the plug off the seat, eliminates drag, prohibits scoring. The resilient plug-face closes dead-shut in any service: gaseous, fluid or fibrous. There's a DeZURIK VALVE to fit your job and solve your problem. Write for bulletin.

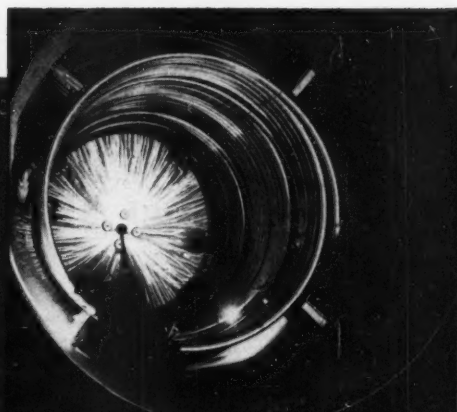


DeZURIK SHOWER CO.
SARTELL, MINN.

August 1952—CHEMICAL ENGINEERING



THIS 15,000 GALLON vessel was built by Pfaudler for fermenting penicillin. Shell is 10% stainless steel clad. Coil is stainless steel.



6 reasons why you get better values with **PFAUDLER** alloy steel equipment

1. SOUND OVER-ALL ENGINEERING

—To deliver your desired results at low cost, Pfaudler's experienced engineering staff pays close attention to such details as size, pressure requirements, heat transfer, agitation, and location of openings. This means that, whatever type of vessel you require, you get many customized features at the price of standard equipment.

2. ALLOY SELECTION—Stainless steel and a complete range of alloys and finishes is available from Pfaudler. Each material is carefully selected to meet your individual requirements and corro-

sion problems. This means maximum service life. And to meet special corrosion problems at low cost, Pfaudler is prepared to heat treat stainless steel equipment in automatically controlled furnaces.

3. ENGINEERED AGITATION

—Whether your process involves gas absorption, emulsification or suspension of solids—Pfaudler has developed formulae and equipment to take the guesswork out of solving agitation problems.

4. MODERN FACILITIES—With expanded facilities, Pfaudler is equipped to deliver your order promptly. And

Pfaudler workmanship is always of the highest quality.

5. PROCESS KNOW-HOW—Pfaudler has specialized in the fabrication of chemical and food processing equipment for 65 years. And Pfaudler process engineers are always prepared to help you with any phase of your process equipment problems—including design, construction, installation, and operation.

6. A COMPLETE LINE of alloy steel reactors, storage tanks and heat exchangers—in a wide range of types and sizes—is available from Pfaudler. Write today for the full details.

Pfaudler

**THE PFAUDLER CO.
ROCHESTER 3, N. Y.**

*Engineers and fabricators of
corrosion resistant process equipment*

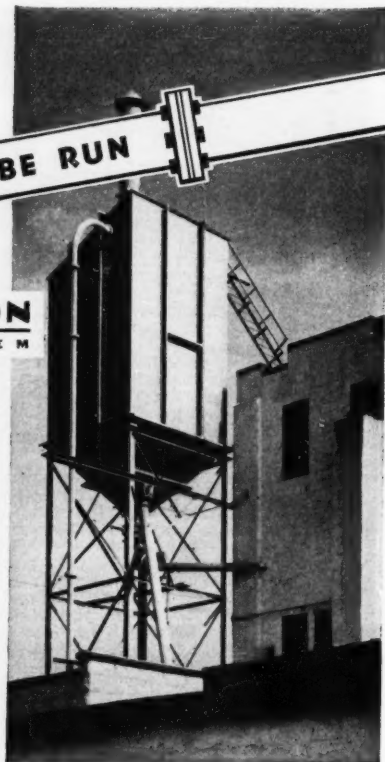
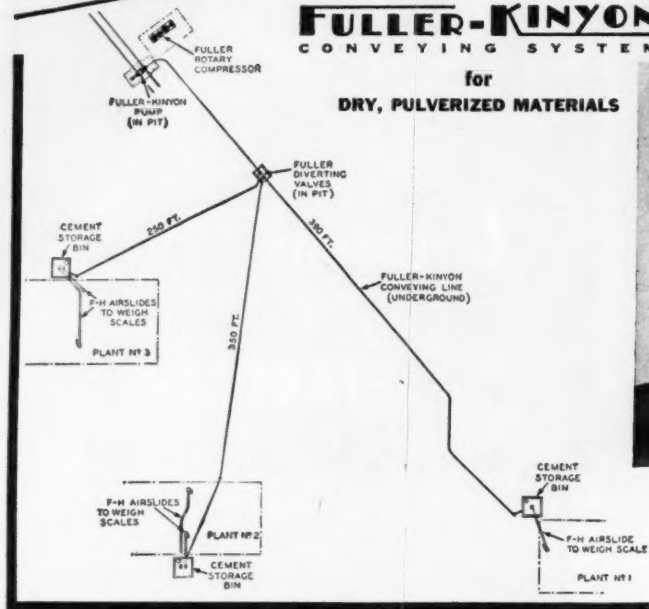
GLASS-LINED STEEL • HASTELLOY • ALUMINUM • CARBON STEEL • SOLID OR CLAD STAINLESS STEEL • NICKEL • INCONEL • MONEL

**Adaptable . . .
Flexible . . .**

ANYWHERE A PIPE LINE CAN BE RUN

**FULLER-KINYON
CONVEYING SYSTEM**

**for
DRY, PULVERIZED MATERIALS**



**Unloading . . .
conveying underground . . .
to three delivery points**

The layout of the concrete-products plant shown above, really three plants in one, necessitated unloading all shipments of Portland cement at one particular location, but distribution to storage had to be made to three widely scattered points.

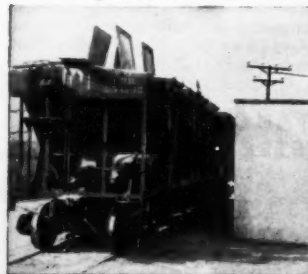
The engineers of this plant turned to Fuller for suggestions and aid in selecting the most efficient and economical method for handling the cement. As a result of studies made, and proposals submitted, they selected the Fuller-Kinyon System. Note that all conveying pipe lines are installed underground, eliminating all structural inter-

ference above ground in the yard.

Cement, received in hopper-bottom cars, is conveyed by the Fuller-Kinyon Pump, located in a pit underneath the tracks, to all storage bins, by the use of Fuller diverting valves in the transport line. The system has a capacity of 200 barrels an hour.

Conveying cement from bins to weigh scales over mixers in the plant, is accomplished by using F-H Airlides, manufactured by us. Airlides are equipped with F-H Airfeeders and F-H air-motor-operated cut-off gates, above the scales, for perfect control of each batch, in addition to clean operation and minimum power consumption.

Fuller engineers will gladly make a survey of your conveying and submit their recommendations, based strictly upon your particular needs. This, without any obligation, of course.



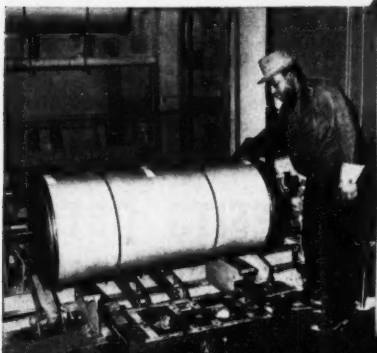
Fuller

**DRY MATERIAL CONVEYING SYSTEMS
AND COOLERS-COMPRESSORS
AND VACUUM PUMPS-FEEDERS
AND ASSOCIATED EQUIPMENT**

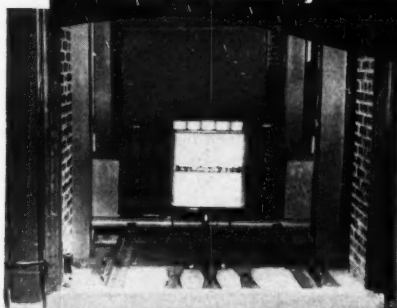
**FULLER COMPANY, Catasauque, Pa.
Chicago 3 • 120 So. LaSalle St.
San Francisco 4 • 420 Chancery Bldg.**

P-137

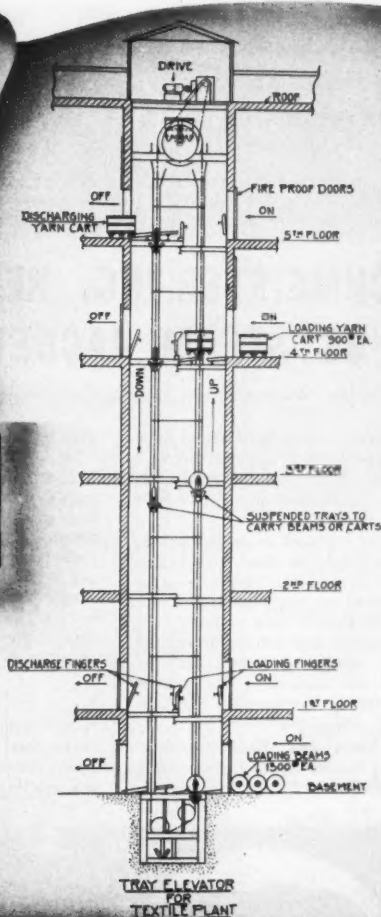
Beam being discharged at predetermined floor



**Only through Engineering...
...can efficiency be achieved**



Loaded box truck on way to desired floor



Firestone

saves \$25,000 a year
with this G-W "Ferris Wheel"

Moving 1300-lb. beams of rayon and 900-lb. box trucks in and out of freight elevators is a back-breaking job. Yet approximately 230 of these bulky loads must be lifted (and empties returned) every day at the Firestone Textiles Division of the Firestone Tire and Rubber Co., Gastonia, N. C.

This Gifford-Wood "Ferris Wheel"—a 6-story roundabout tray elevator—has assumed most of the work load. Beams and trucks are automatically picked up on the loading side of a shaftway by trays suspended between two endless chains, carried to the top, eased over the drive sprockets, lowered to the desired floor, and automatically discharged.

The \$25,000 annual saving is basically one of reduced labor requirements and improved handling efficiency, and the limited manual work remaining is much less strenuous than formerly.

This is just one of many conveyors born of G-W ingenuity and experience—a product of efficiency through engineering. Call on G-W Materials-Handling Engineers to survey your present methods; you are under no obligation. It might well prove to be a step toward higher profits through lower operating and maintenance costs.

When You Think of Materials Handling—Think of **GIFFORD-WOOD CO.**

Since 1814 • Hudson, New York

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420 LEXINGTON AVE.

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RAILWAY EXCHANGE BLDG. 565 W. WASHINGTON ST.

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Ⓢ 8405

HACHMEISTER-INC. REVEALS BENEFITS OBTAINED BY SK STEAM JACKETED PUMP'S PERFORMANCE

("On-The-Job" Illustration and Story by Courtesy of Hachmeister-Inc. of Pittsburgh, Pa., makers of Hako Products)

"SK Steam Jacketed Pumps have proved very advantageous for us," states Mr. H. J. Snyder, Plant Engineer, Hachmeister-Inc., and tells why as follows:

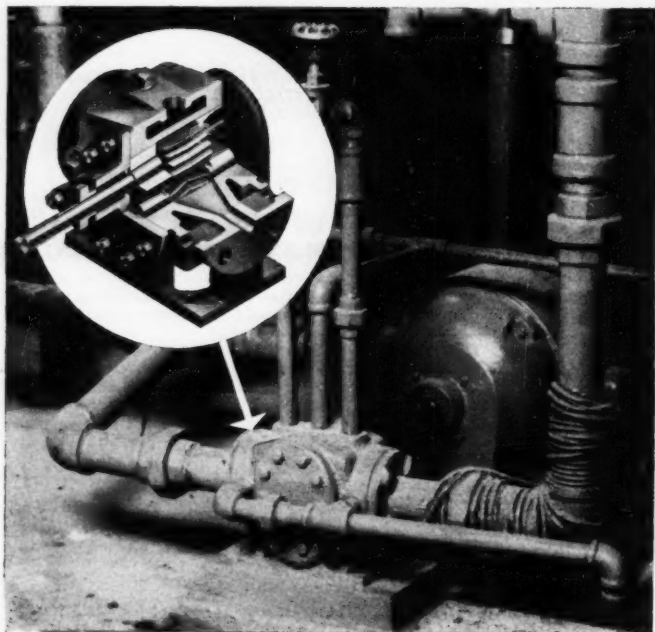
"We have benefited in our operations because: First, the steam jacket eliminates the need for outside heating necessitated by the viscosity of our material; second, they pump a wide range of thick and thin liquids equally as well; third, they have greatly increased our capacities; and fourth, absolutely no maintenance has been required since installation."

Three years ago, Hachmeister-Inc. installed the SK Steam Jacketed Gear Pump illustrated for use in connection

with the manufacture of Hako-Short.

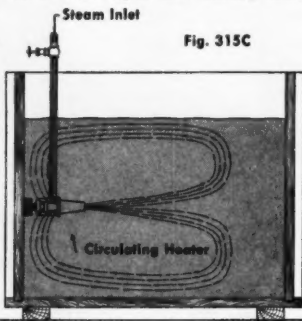
Since then, the pump has been used to distribute various fats and oils from storage to mixing and blending kettles. It is gravity fed from three 300 gal. stainless steel kettles and pumps the material a vertical distance of 10 ft. and a horizontal distance of 42 ft. to supply three other 300 gal. mixing kettles. Using 2" ID inlet and discharge pipes, the pump handles approximately 15 gpm of material.

If you are handling or are planning to handle liquids with viscosities which necessitate the use of high temperatures, investigate this pump. Details are available on request.



SIMPLE JET HEATER HEATS AND CIRCULATES LIQUIDS IN TANKS

SK Fig. 315 Circulating Heaters operate on jet principle to heat and circulate liquids in open tanks. Steam enters heater through inlet at top of heater and issues through a double steam nozzle in the form of two jets—one an annular suction jet and the other a straight forcing jet. The entrainment action of the suction jet draws tank liquid into mixing nozzle



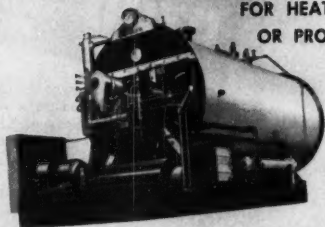
and discharge tube where it is heated by the steam. The forcing action of the central steam jet discharges liquid from heater and causes continuous circulation within tank.

These heaters offer several outstanding advantages which are explained in detail in Bulletin 3-A. Ask for a copy.



STEAM

FOR HEAT
OR PROCESS



A complete steam plant backed by undivided responsibility • Shipped completely assembled • More than 80% thermal efficiency guaranteed • 4-pass design provides 5sq. ft. of heating surface per b.h.p. • Built-in induced draft eliminates need of expensive chimney • Simple installation • Clean, quiet operation • Heavy-duty construction assures long-lived dependability

Superior Steam Generators are manufactured in 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water heating.

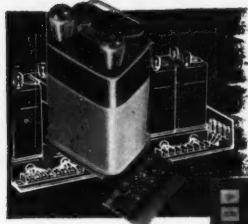
For complete details, write for Catalog 322

UNION CHURCH INDUSTRIAL

Factory: Emmaus, Pa.

Exec. Office: Times Bldg., Times Sq., New York N. Y.

SUPERIOR
STEAM GENERATORS



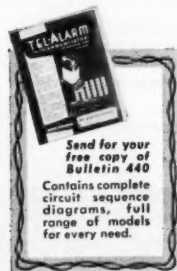
New TEL-ALARM "Unitized" ANNUNCIATOR SYSTEM

- WIDE VARIETY OF CIRCUIT ARRANGEMENTS TO MEET ANY NEED
- HERMETICALLY SEALED UNITS—CORROSION PROOF
- BACKLIGHTED NAMEPLATES OR TURRET LENSES
- STANDARDIZED FOR EASY USE—LOWER COST

HERE is the first "unitized" annunciator. Tel-Alarm incorporates a basic relay unit with many different circuit arrangements available because of a unique switchboard circuit-header. Tel-Alarm is completely standardized for low cost and easy maintenance.

Tel-Alarm is corrosion proof, hermetically sealed and meets any Class I, Division 2 application. The units are completely self-contained—no complicated wiring—and merely plug into a standard Tel-Alarm chassis. Simple and easy to install.

You can get backlighted nameplates or the new Tel-Alarm giant turret lenses for greater visibility. Check into Tel-Alarm today.



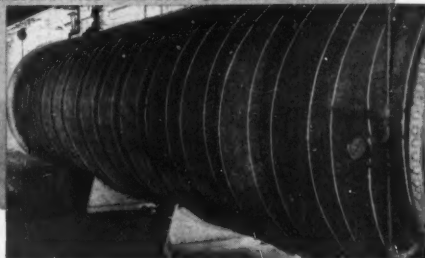
Send for your free copy of Bulletin 440
Contains complete circuit sequence diagrams, full range of models for every need.

Tigerman Engineering
COMPANY
4332 North Western Ave., Chicago, Ill.
"Protecting America's Industry"

THERM-ENOMICS[®] by Baldwin-Hill

how Keeping Heat in a Vulcanizer

MEANS ALL-AROUND SAVINGS FOR YOU



1. Wrap B-H metal-reinforced Black Rockwool Blankets around the vulcanizer's external surface—but blanket edges carefully to secure a blending interlock. B-H Blankets are excellent insulation for any curved or irregular surface and give protection up to 1200°F.

*Saves
overlapping
waste*

2. Bind blankets with galvanized steel bands, but FORGET about wrapping the blanketed area with wire or metal fabric. The metal-reinforcing layer built into every B-H Blanket forms a perfect binding and base for finishing cement.

*Saves
one complete
operation*

3. Apply one thickness of Powerhouse Cement—let it dry and paint the finished coat. B-H Powerhouse Cement forms a perfect bond with the B-H Blanket and dries quickly to a smooth, paintable surface.

*One coat
application
Saves time*

Baldwin-Hill insulations are designed for more than effective, efficient heat saving... they're also designed to save you time and money... Therm-economically. Send for complete information today.

*Economics of engineered heat control.

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PLEASE SEND ME COMPLETE INFORMATION ON:

- ☐ BLANKETS (Metal-bonded, versatile, Black Rockwool Overall Insulation)
- ☐ POWERHOUSE CEMENT (High-adhesion, Black Rockwool Insulating-Finishing Cement)
- ☐ MOHO-BLOCK (Porous, felted, Black Rockwool Insulation Block)
- ☐ NO. 1 CEMENT (Plastic, rust-inhibiting, Black Rockwool Insulating Cement)

BALDWIN-HILL COMPANY, 852 BREUNIG AVENUE, TRENTON 2, N. J.

Now available
a new improved
plastic diaphragm ...



**"L-2" diaphragms offer new
high standards of performance
in many severe services**

For a wide variety of severe services, including the valving of 66" Bé sulfuric acid, the new, improved "L-2" diaphragm offers physical and service characteristics never before available. Like its predecessor, the "L-1", the "L-2" diaphragm is made of polyethylene specially compounded to provide high resistance to strong acids and other highly active materials.

Hills-McCanna diaphragm valves with "L-2" diaphragms are available with a choice of manual, remote or automatic operators and with bodies of any machinable alloy or with rubber, Neoprene, glass or lead linings. Sizes range from 3/8" through 14". "L-2" diaphragms permit operation at temperatures to 125°F and pressures to 100 psi. Other diaphragms available are Kel-F, Neoprene, rubber, Hycar, Tygon, and butyl. Depending on material, these may be used at pressures to 150 psi, temperatures to 220°F.

Write for complete details. HILLS-McCANNAs CO., 2341 W. Nelson St., Chicago 18, Ill.

HILLS-McCANNAs

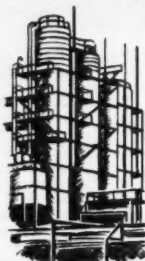
saunders patent diaphragm valves

Also Manufacturers of Proportioning Pumps

Force Feed Lubricators • Magnesium Alloy Castings

USE ALMET 430
FOR INSULATION BANDS & WIRE
STOP COSTLY REPAIRS!
CORROSION!
RUST!

Why risk costly shutdown due to rusting through of insulation bands and wire. Specify ALMET 430 Stainless Steel Bands and Wire throughout your plant. Corrosion resistant to most acid and chemical fumes.



ALMET 430 strips available in .015" and .020" thicknesses and in widths from 3/4" to 1 1/4", or wire in .045" and .065" diameter. Other sizes available if required.

When drawing plans for a new plant or making repairs to existing insulations specify ALMET 430 for future assurance.

**NO PRIORITY NEEDED!
IMMEDIATE DELIVERY!**

Call or write us today for prices.
ALLOY METAL WIRE CO., INC.
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**WHITON
LABYRINTH
SHAFT SEAL ...
SINCE 1911**

Whiton Turbines in service 25 years without seal replacement.

BECAUSE:

- Factory run-in assures perfect seal and minimum wear.
- Labyrinth seals do not contact shaft, eliminating wear and seizing.
- Steam ejector feature positively prevents steam leakage at outer end of shaft seal.

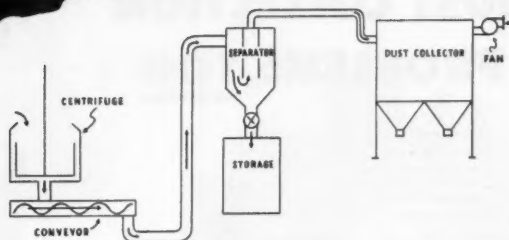
Write for complete details



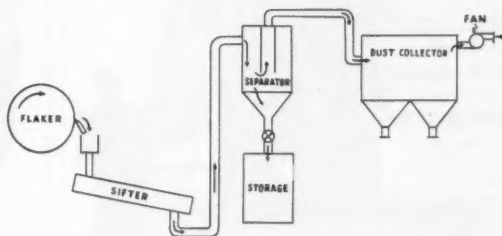
**WHITON
MACHINE COMPANY**
New London 14, Conn., U.S.A.

A MIDWEST CHEMICAL CO.

saves
\$112,500
annually
salvages
600,000 lbs.
of chemicals with



Two complete Dustube Dust Control systems are used to eliminate dust nuisances in this midwest chemical plant. In one system about 25,000 lbs. of very fine material is handled daily. From 5% to 7% of this dust escapes preliminary separators and is trapped in a Dustube Collector. As this dust is worth 15c a pound, a minimum of \$187.50 is saved each day.



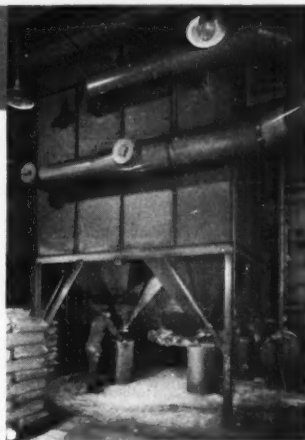
In the second system which ventilates chemical processing stations, a minimum of 750 pounds of valuable material is recovered each day with a Dustube. At 25c per pound, the product recovered daily has a value of \$187.50.

DUSTUBE dust control

The two Dustube Collectors installed at this chemical company have paid for themselves many times over with their thorough dust removal. As explained above, these collectors are saving \$375.00 daily in product recovery alone.

In addition, the Dustube Collectors' highly effective filtering action traps even the finest dust with virtually 100% efficiency to keep the plant completely dust free. Their simple, practical design provides the highest efficiency at an unusually low operating cost.

Let Dustube engineers show you why users everywhere say: "It pays to own a Dustube."

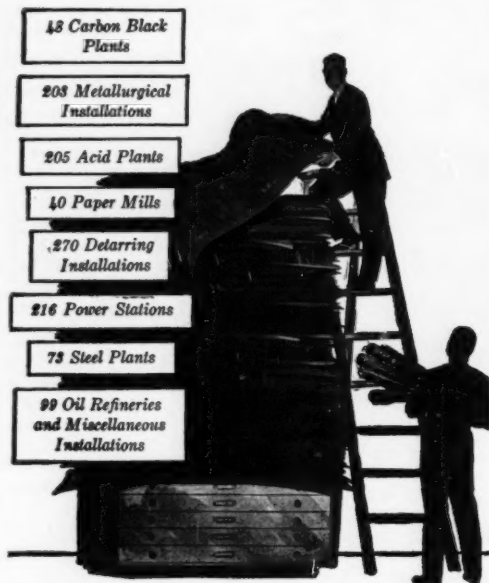


This new catalog explains how Dustube Collectors combine the proven efficiency of cloth filtration with a unique operating simplicity and economy. Write for your copy of Catalog 372.

American
WHEELABRATOR & EQUIPMENT CORP.
347 S. Byrkit St., Mishawaka, Ind.

dustube
COLLECTORS

All These Were Once DUST COLLECTION PROBLEMS, TOO



Your electrical precipitator installation will be individually engineered . . . and based on the Research Corporation's experience graphically shown by that towering pile of thousands of blueprints.

This knowledge is a valuable asset that will help Research engineers "tailor-make" your Cottrell installation. For example, they can more quickly determine the right answers to such variables as the size, shape and type of both discharge and collecting electrodes, their relative spacing, flue arrangements and many other factors. At Research you can count on profitable solutions to individual problems.

In one chemical plant, for example, a Research Corporation Cottrell collects 3500 pounds of concentrated sulphuric acid every day. An informative booklet gives valuable information on this and other chemical plant installations. Write for your free copy.

RC-119

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6 TONS OF SODA SALT
AT A PAPER MILL

50 TO 100 TONS
OF CATALYST

250 TONS OF FLY ASH

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LUBRICATION ECONOMY

"LUBRIPLATE improves Machine Operation"



The PACKAGE MACHINERY COMPANY of Springfield, Mass. writes "To assure the use of LUBRIPLATE Lubricants for re-lubrication of our machines in use, we place tags on them before shipment; thus the purchasers of these machines know the LUBRIPLATE product to use for each application."

1. LUBRIPLATE reduces friction and wear

2. LUBRIPLATE prevents rust and corrosion

3. LUBRIPLATE is economical to use

Write today for case histories of savings made through the use of LUBRIPLATE in your industry.

LUBRIPLATE DIVISION
Finke Brothers Refining Co.
Newark 5, N. J. Toledo 5, Ohio

*The Different
LUBRICANT!*

DEALERS EVERYWHERE, consult your Classified Telephone Book

GAYCO CENTRIFUGAL SEPARATORS

GAYCO Separators, equipped with the adjustable centrifugal sizing fan—an exclusive GAYCO feature—make closer separations. Closer separations bring about higher production through efficient removal of the fines made by the mill. Closer separations bring about higher quality products by eliminating all undesirable oversize.

"TIMKEN GEARING EQUIPPED"

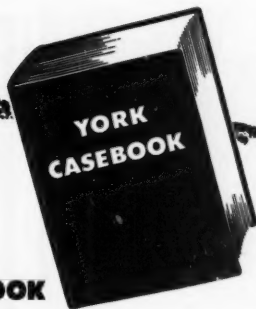
GAYCO brings you all these:



If you have an exceptionally hard separating problem
TRY THE GAYCO

Universal Road Machinery Co.

Robert M. Gay-Division
Factory and Laboratory, Kingston, N. Y.
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FROM
THE CASEBOOK
THAT COVERS
THE INDUSTRY

YORK cuts cooling costs three ways

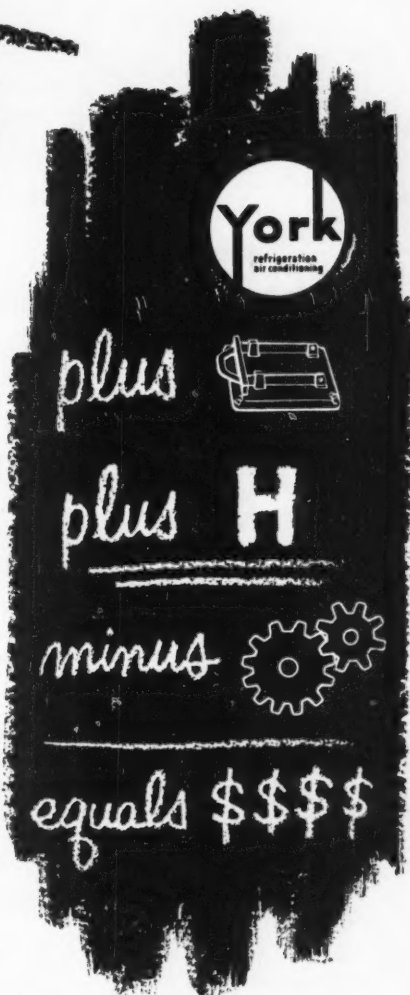
By reducing cooling costs, York refrigeration equipment increases profits.

In a Texas chemical plant which produces daily 100 tons of anhydrous ammonia, a York absorption system provides 500 tons of refrigeration at 5°F. temperature and 200 lbs. gauge condensing pressure. Costs are kept well below par because of three important economy factors:

1. The number of personnel required is minimized by the system's *automatic* operation.
2. Operating costs are lowered because the system is operated by waste hydrogen obtained from the manufacture of liquid chlorine.
3. Maintenance costs are reduced because only one piece of equipment has moving parts, less repairs are needed . . . and there's less wear due to motion.

In addition to economy and efficiency in equipment, whether Absorption Systems, Turbo Compressors or other equipment, York offers you the world's finest refrigeration service facilities. In forty Branch Offices from coast to coast, York-trained engineers are available to aid you in planning and installing refrigeration, air conditioning and ice-making equipment. Behind these York industrial cooling specialists lies a wealth of experience in tailoring York equipment to the needs of every size of plant and every type of industry.

Give your nearest York Branch Office a call today. Or write for full details to York Corporation, York, Pennsylvania.

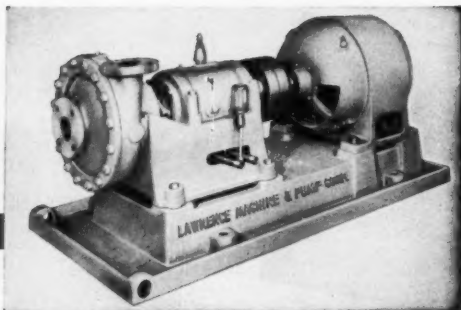


The great new Superliner, S.S. UNITED STATES, has York Air Conditioning and complete York Refrigeration for ship's stores and ship's cargo space!



THE BIG ADVANCES COME FROM **YORK**
HEADQUARTERS FOR MECHANICAL COOLING... SINCE 1885

Lawrence Process Pump

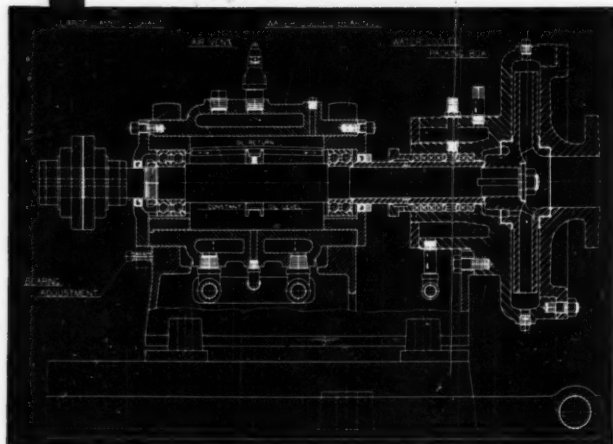


PROCESS PUMPS for HANDLING LIQUIDS at HIGH TEMPERATURE and HIGH PRESSURE

The pumping of corrosive and/or abrasive liquids at high temperatures and pressures requires design techniques beyond the capabilities of most pump manufacturers. Lawrence engineers have specialized in this difficult field for over 80 years and can offer you the benefits of their broad experience.

Typical of Lawrence advanced engineering is the process pump illustrated, made from corrosion-resistant metals with packing box and bearing housing both water cooled. Note also the clean-cut appearance and accessibility of the principal components.

If you have a difficult pumping problem, write us the pertinent details. No obligation.



LAWRENCE
MACHINE & PUMP CORPORATION
369 MARKET STREET, LAWRENCE, MASS.

Smooth Vibrationless PROPELLERS

for MIXING, STIRRING
AERATING, PUMPING
AGITATION



A Michigan 34" Stainless Steel propeller with split hub for mounting in receptacle through manhole.

Manufactured by an exclusive process, Michigan propellers are perfectly balanced to avoid whip and strain on shafts. They are available for original equipment, replacement or special application in a wide range of materials and in sizes up to 60". Write for latest data folder.

MICHIGAN WHEEL CO.
GRAND RAPIDS 3, MICH.

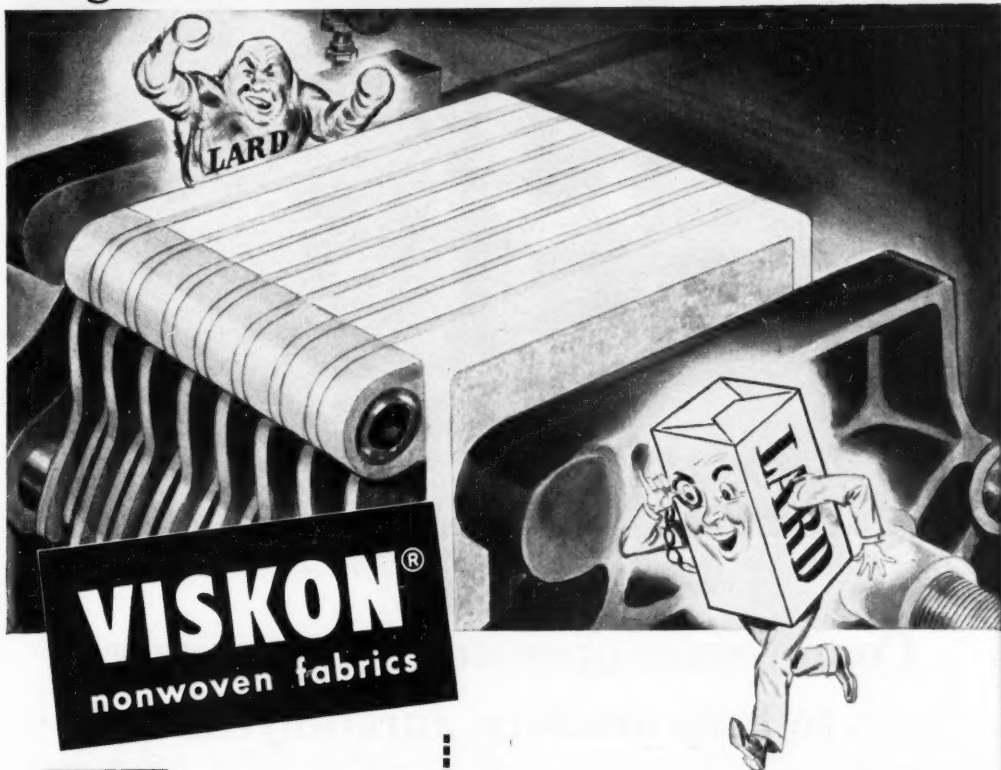


STOPS FALLS!

Revolutionary New Type Safety Grating Eliminates Dangerous Walking Conditions... Guarantees Sure Footing.

In a recent test, shown above, a stock strip of Bustin Firm-Grip Grating was submerged in heavy chassis grease and then raised to a 15° slant. Even under those conditions, a man carrying a bulky box walked easily up and down the strip... maintaining perfect balance! Send for free Bustin booklet that shows industrial safety applications and specifications. Bustin Firm-Grip Grating Corp., 110 E. 130 St., New York 37, N. Y.

Tough Customer turns out Refined and Polished!



VISKON®
nonwoven fabrics

VISKON IS STRONG WHEN WET!

A great advantage over paper filters—offers high wet strength, longer filter life, greater dependability.

VISKON IS DURABLE!

Insoluble in common organic solvents—ideal for use under high pressure and heat conditions.

VISKON HAS HIGH FLOW RATE!

Gives maximum flow rate with required clarity. Filtering cycle is lengthened.

VISKON IS ECONOMICAL!

Down time is reduced—clean-up time costs less than woven fabrics.

VISKON nonwoven fabrics

... another product to fit today's needs by

THE VISKING CORPORATION
NORTH LITTLE ROCK, ARKANSAS

New VISKON simplifies, improves hot lard refining for major packing house*

Filtering and polishing hot lard under high pressure was a tough problem for a leading midwestern meat packer. Then they switched to **VISKON** nonwoven rayon fabric backed with regular canvas ducking. **VISKON** performed the final polishing job with high efficiency—throughout the entire filtering cycle. Down time for cleaning and dressing was greatly reduced.

VISKON is insoluble in common organic solvents, has exceptionally high flow rate, porosity and resistance to deterioration. And, with all these important advantages, **VISKON** is economical!

VISKON is made from textile fibers bonded with cellulose, either cotton or rayon or a combination of both. Whatever your individual needs, **VISKON** can do a better job for you.

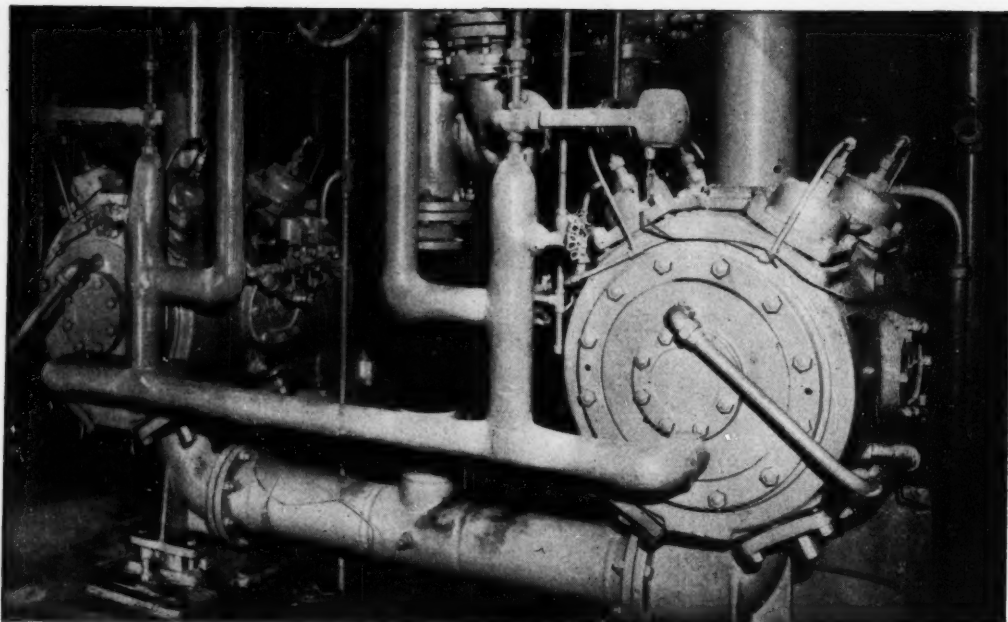
Investigate today . . . write for complete information.

*Name in Our Files

THE VISKING CORPORATION, DEPT. CB
Box 72, North Little Rock, Arkansas

Please send us additional information and samples of **VISKON** nonwoven fabrics.

Name
Position
Company
Address
City Zone State
Name of equipment used



CONTINUOUS OPERATION of this Worthington Type DC Horizontal Compressor helps keep aureomycin production up at Lederle Laboratories plant in Pearl River, N. Y.

Compressor operates continuously to help produce aureomycin

- **Installed for Lederle Laboratories in 1949, unit operates at 100% capacity day and night.**

No rest periods for this duplex compressor. When you're producing antibiotics like aureomycin, you just can't afford them!

The Lederle Laboratories Division of American Cyanamid Company anticipated rigorous operating requirements when they installed this Worthington

horizontal compressor back in 1949.

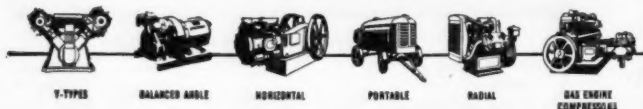
They wanted it to supply compressed air for use in the production of aureomycin—24 hours a day, seven days a week, at 100% capacity. The fact that the unit has operated since installation in 1949 with no attention other than routine maintenance is but "normal" for a sturdy Worthington compressor like this one.

This Type DC compressor has the exclusive Worthington Feather* Valve, deep, full-area cylinder water jackets, extra-large bolted gasketed clean-out covers—just some of the reasons why *there's more worth in Worthington*.

Remember Worthington's auxiliary equipment, too. Write to Worthington Corporation, Compressor Division, Buffalo, New York.

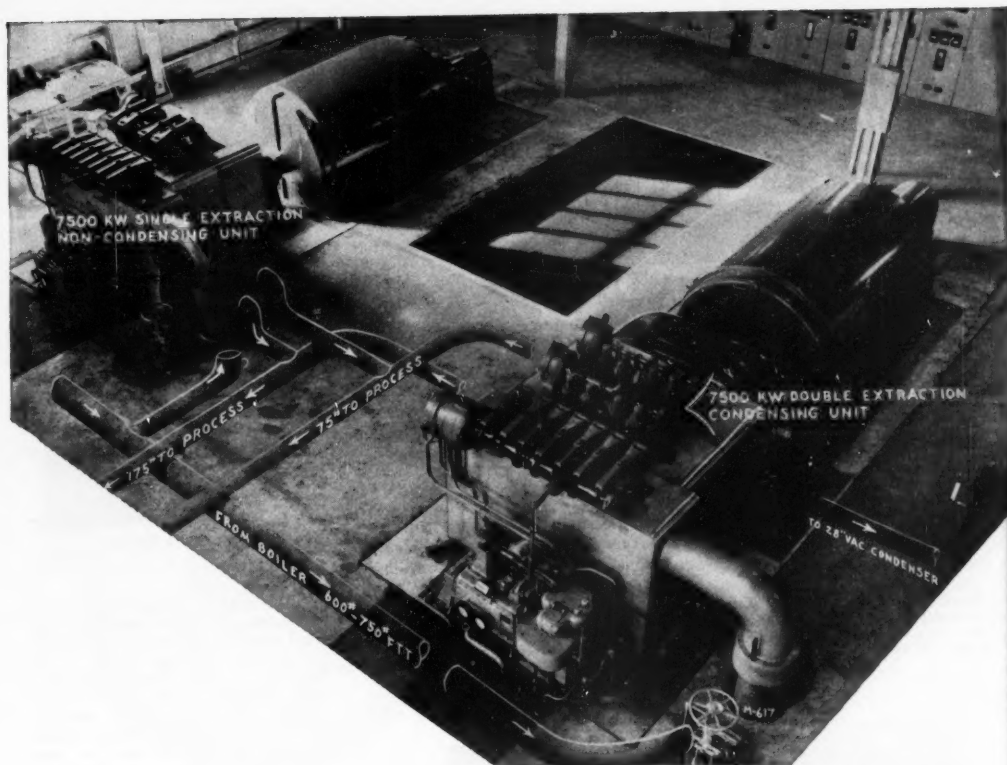
*Reg. U. S. Pat. Off.

K.2.1



No Other Compressor Will Outperform a Worthington





Process Steam Maintained at 2 Pressures *by Worthington* Turbine Generators

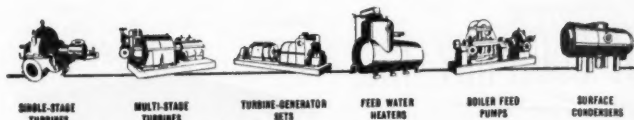
This is how Worthington and a Far West cellulose mill set up the steam supply for utmost efficiency and flexibility.

We combined a non-condensing single automatic extraction unit with a condensing double automatic extraction unit. The 7500-kw units operate in parallel and, in addition to supplying plant power, furnish steam at two pressures for process requirements.

Along with the advantages of efficient operation and low cost and ability to adjust to mill requirements, this mill benefits from the manufacturer's unit responsibility. In this case, Worthington also furnished two 470-hp turbines to drive boiler feed pumps, two 452-hp turbines to drive induced-draft fans, two 146-hp turbines to drive forced-draft fans, and one 50-kw turbine-driven exciter set.

If you want proof *there's more worth in Worthington*, write Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, New York.

T.2.6



SINGLE-STAGE
TURBINES

MULTI-STAGE
TURBINES

TURBINE-GENERATOR
SETS

FEED WATER
HEATERS

BOILER FEED
PUMPS

SURFACE
CONDENSERS

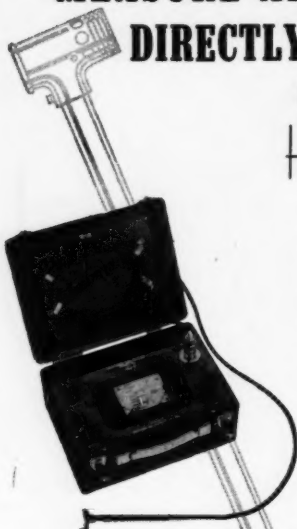
A GREAT TEAM IN STEAM

WORTHINGTON

Steam Turbine Generators

MEASURE AIR VELOCITY DIRECTLY AND ACCURATELY

WITH A HASTINGS AIR-METER



Hastings Model H Air Meter. Compact unit for field and laboratory use. Velocity Ranges: 10-750 fpm; 750-5500 fpm.



Hastings Model B Air Meter for measurements of greatest precision. Velocity ranges: 0-400 fpm; 400 to 6,000 fpm. Meter type continuous calibration check. Knife edge, parallax free indicator.

Write for descriptive literature and prices on Hastings Air Meter, Manometer and Flowmeters, and Vacuum Gauges.

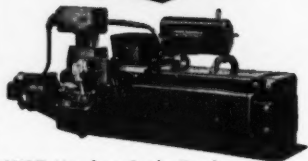


Hastings Model G Air-Meter. Small hand type instrument. Velocity range: 0-6000 fpm; Weight: 26 ounces.

The most sensitive of all air meters for research, industrial and agricultural applications. Reads directly in feet-per-minute on a logarithmic-type scale expanded at lower velocities. Highly sensitive — will indicate the velocity of smoke rising from a cigarette. Response time less than one second. Accurate to within $\pm 2\%$ regardless of ambient temperature or static pressure.

Uses the exclusive Hastings noble metal thermopile in an extremely stable circuit. Instantaneous range switching without recalibration. Probes available for directional or non-directional reading. Easily adapted for remote recording since the calibration is independent of lead length. Available in several models to meet your specific requirements.

ACCURATE PROCESS CONTROL with W&T MERCHEN FEEDERS



W&T Merchen Scale Feeder

Successful process control — particularly in today's modern, high-speed plants — generally depends on the accurate feeding of dry, free-flowing, chemicals. Continuous, precision feeding — by weight — is essential to a uniform end product. And that's what W&T Merchen Scale Feeders can demonstrate in your plant, just as they are doing in hundreds of others.

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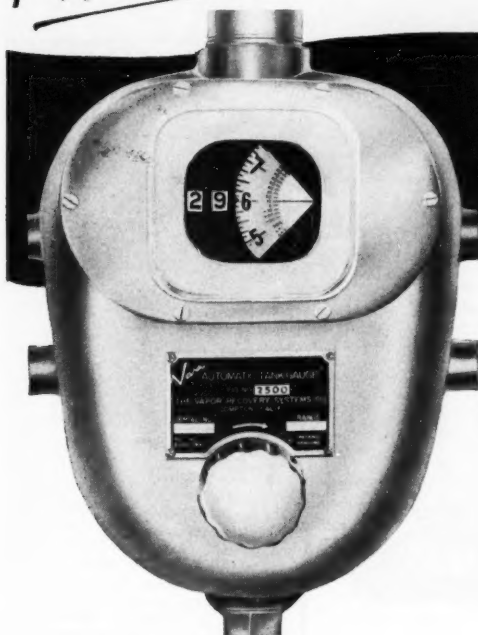
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FIGURE NO. 2500
AUTOMATIC
TANK GAUGE

FOR ALL TYPES OF LOW PRESSURE TANKS
READINGS UP TO 70 FT.

"VAREC", a pioneer in the development and manufacture of automatic tank gauging equipment has applied new fundamentals of design and operation to the Figure No. 2500 Gauge for the ultimate in accurate liquid level reading and dependable, trouble free operation.

Representing a major improvement with this new concept of simplified automatic tank gauge design, the "VAREC" Figure No. 2500 now utilizes the revolutionary Neg'ator Motor (Pat. No. 2,063,799) housed within the gauge head, to maintain a predetermined constant tape tension. This eliminates the need for a conventional counterweight.

Here's a
Look Box
You Can Read
Easily,
Accurately!

(Shown approximately 1/2 actual size)



EASIEST TO INSTALL because:

Both counterweight and counterweight pipe have been eliminated. This permits installation of the look box at any desired height from the ground or on top of tank.

EASIEST TO READ because:

Full view Counter in the Look Box for quick, accurate reading of foot increments and a dial for reading inches and fractions. Use of large distinct numerals minimizes chance of reading errors. Eliminates calibrated tape.

EASIEST TO OPERATE because:

"VAREC" patented Gravity Compensator (Pat. No. 1879805) is incorporated with "inch reading" dial. An external Gauge Check device (Pat. No. 2555593) permits manual checking of gauge operation when desired.

EASIEST TO MAINTAIN because:

All internal parts of the Figure No. 2500 Look Box are non-sparking in contact with each other. Non-corrosive Graphitar tape sheave bearings — self lubricating.



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The "VAREC" Figure No. 2500 Automatic Tank Gauge is gas tight. It is adaptable to all types, arrangements and installations of low pressure tanks up to 70 feet in height. "VAREC" Figure No. 2500 Gauge Head is available as a separate unit and can be installed on existing float operated type tank gauges utilizing 1/2" wide tape sheaves.

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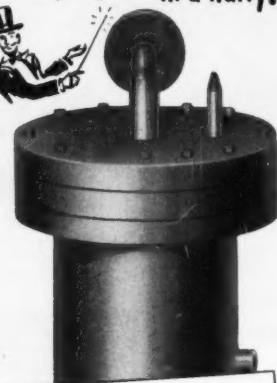
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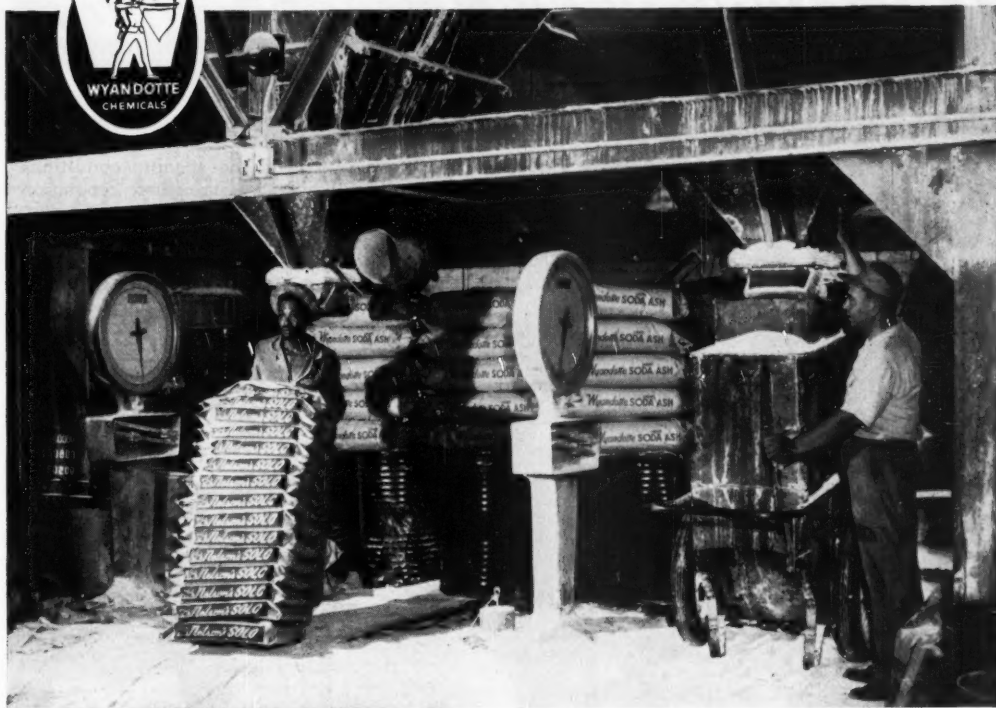
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Dependable Source for Chemical Raw Materials



Nelson Chemicals' plant superintendent, Jack Schey (right), loads bin cart from huge soda ash hopper. Bags in background are for Nelson's customer needs.

Wyandotte Technical Service saves Nelson Chemicals \$25,000 a year!

Handling cost of Wyandotte Soda Ash is reduced 90%!

Nelson Chemicals Company, Detroit, was buying Wyandotte Soda Ash in 100-lb. bags.

"Then," relates Mr. Harold R. Nelson, Nelson Chemicals Company, "Wyandotte Technical Service engineered equipment which enabled us to unload soda ash from a car into two 100-ton capacity hoppers in our plant. This installation saves us the difference between bag and bulk purchases and cuts handling costs 90%. It paid for itself within two years, and we enjoy a

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dependable source of supply for you, too. Recent expansion of soda ash production facilities means an even greater supply to meet your future needs.

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For Dependable Flow Control

Specify POWELL VALVES



Fig. 1847—Small 200-pound Swing Check Valve with screwed-in cap and grindable, renewable disc. Available in a wide variety of corrosion-resisting metals and alloys.

Because Powell Valves are engineered to meet the specific conditions under which they must operate, they have an established reputation for long, dependable performance with minimum maintenance.

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The Wm. Powell Co., Cincinnati 22, Ohio

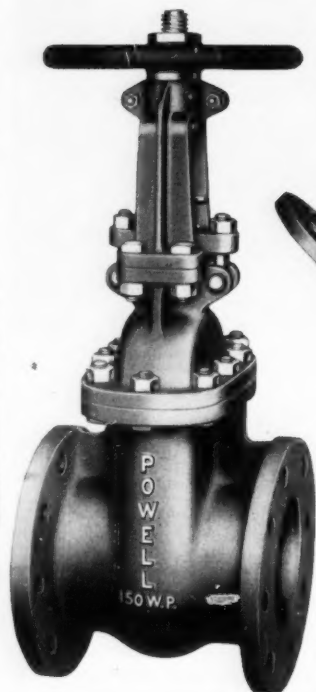


Fig. 2453-G—Large size 150-pound Stainless Steel O. S. & Y. Gate Valve with precision fitted, accurately guided, solid or split wedge. They are interchangeable. Made with separable yoke arms in sizes 5" to 30", incl. Conforms to all the latest standards. Available in a wide selection of other corrosion-resisting metals and alloys.



Fig. 2310—Small Flush Bottom Tank Valve with disc lowering into valve to open. Sizes $\frac{3}{4}$ " to 3", incl. Also made with disc rising into tank to open. (Fig. 2309). Available in sizes 4" to 8", incl. in other designs.



Fig. 1891—Liquid Level Gauge with flanged ends. Equipped with O. S. & Y. rising stem valves.

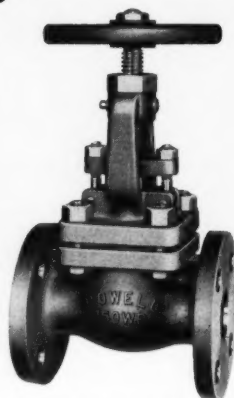


Fig. 2475—150-pound O. S. & Y. Globe Valve. Stem is threaded and guided through a bushing screwed into upper yoke which has a compression lubricant fitting. Seat and plug type disc easily reground if necessary. Conforms to latest standards. Available in a large selection of corrosion-resisting metals and alloys, with bolts and nuts in stainless steel. Also with screwed ends.

Powell Corrosion-Resisting Valves are made in these Metals and Alloys

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18-8S Mo.	3% Nickel Iron	Monel Metal*	Herculoy	4-6% Cr. 5% Mo.
18-8S Co.	Ni-resist*	Inconel*	Ampcoloy††	3.5% Nickel Steel
Misco "C"			76	6-8% Cr. 5-.75% Mo.
Durimet 20	Aluminum	Hastelloy Alloys†	90-10	8-10% Cr. 1.1-1.5% Mo.
11.5-13.5% Cr. Iron	Alcoa No. 43	(A, B, C and D)	88-10-2	
18% Cr. Iron	Alcoa No. B-214	Illium		Silver Hard Lead
28% Cr. Iron	Alcoa No. 61 S-T	D-10		Molybdenum
25% Cr. 12% Ni.				

*Registered trade-names of the International Nickel Co., Inc.

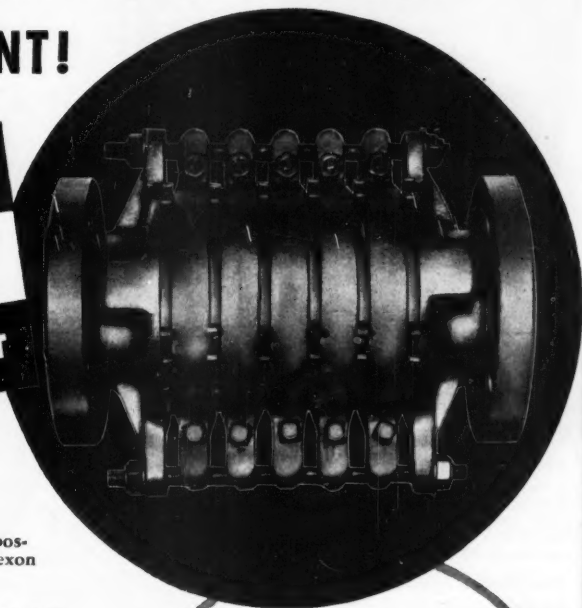
†Registered trade-name of the Haynes-Stellite Co. ††Registered trade names of Ampco Metal, Inc.

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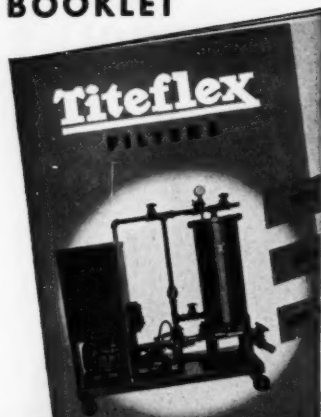
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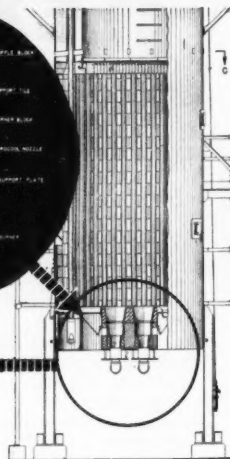
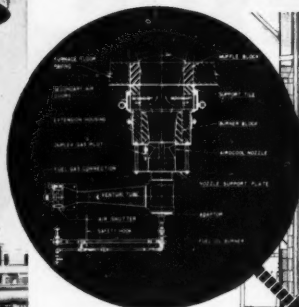
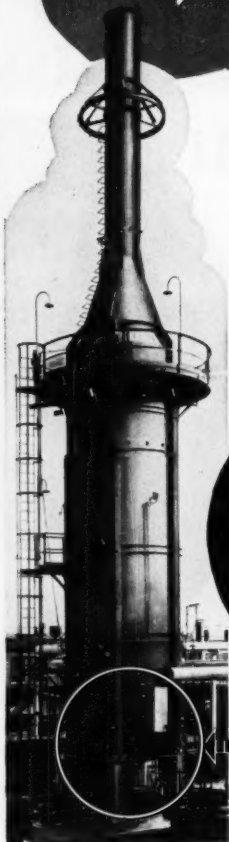
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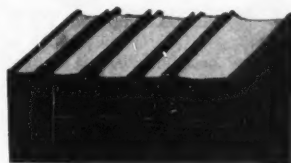
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National AAA detergent manufacturer seeks fully qualified Production Manager. 40-50, good basic education in Chemical or Industrial Engineering or equivalent. Prefer ten or more years experience on all phases of production, including top management participation, in medium size company doing bulk and small unit high speed packaging of dry products. Excellence in human relations is a prime requisite. Salary open. If you are interested in a life-time career and excellent future with a multi-plant, growing concern, submit complete details in confidence first letter.

P-4544, Chemical Engineering
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Well established Ohio company has attractive representation arrangement for experienced sales engineers in chemical and related industries. An entirely new line in the field of cost-saving equipment, supported by national advertising. Sales coverage desired in Cleveland, Cincinnati, Pittsburgh, and in Charleston, West Va. Give full resume of experience and references. Inquiries will be held in strict confidence. Reply

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330 W. 42 St., New York 36, N. Y.

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W. Alec Jordan
Chemical Week
330 W. 42nd St. New York 36, N. Y.

WANTED ASSISTANT CHEMIST

FOR SUGAR FACTORY NEAR LARGE CITY IN CANADA

Requirements: Approximately 30 years of age, chemistry or chemical engineering degree, several years best sugar laboratory experience and possibly some knowledge of cane sugar refining. Good permanent position for qualified man, starting as soon as possible. In application, which will be kept confidential, state personal data, education, experience, references, remuneration expected and attach photograph. Reply without delay to

P-4967, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 530 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

CHEMICAL ENGINEER GS-12, \$7040 per annum—Duties: Head of the Special Projects Branch, Propellants Division, Engineering Department. Directs specialized investigations into the problems of combustion of solid and liquid propellants in rocket engines, determination of physical and thermodynamic properties of propellants, studies of corrosion of materials by propellants. Applicants should complete Standard Form #57, Application for Federal Employment, which is available at any post office, and forward to the Industrial Relations Officer, Industrial Relations Department, U. S. Naval Air Rocket Test Station, Lake Denmark, Dover, New Jersey.

CHEMICAL ENGINEER GS-9, \$5060 per annum—Duties: Project engineer in the Special Projects Branch, Propellant Division, Engineering Department. Conducts specialized investigations into the problems of combustion of solid and liquid propellants in rocket engines, determination of physical and thermodynamic properties of propellants, studies of materials for storage and handling of propellants. Prepares reports. Applicants should complete Standard Form #57, Application for Federal Employment, which is available at any post office, and forward to the Industrial Relations Officer, Industrial Relations Department, U. S. Naval Air Rocket Test Station, Lake Denmark, Dover, New Jersey.

CHEMIST GS-5, \$3410 per annum—Duties: Junior chemist in the Chemistry Branch, Propellant Division, Engineering Department. Performs quantitative and qualitative analysis of solid and liquid fuels and oxidizers. Assists senior chemist in specialized investigations of chemical properties of propellants and handling materials. Applicants should complete Standard Form #57, Application for Federal Employment, which is available at any post office, and forward to the Industrial Relations Officer, Industrial Relations Department, U. S. Naval Air Rocket Test Station, Lake Denmark, Dover, New Jersey.

ENGINEER To assist manager of Quality Control Department of large diversified manufacturing company. Some experience in statistical quality control work, manufacturing and finished product specifications, sales coordination required. Chemical education preferred. Write giving full details of past experience, personal data and salary required. All replies will be held in strictest confidence. P-4873, Chemical Engineering.

(Continued on the opposite page)

CHEMICAL ENGINEER

Large Western New York synthetic organic chemical plant has attractive permanent position for Chemical Engineer, preferably with 2 to 3 years' industrial experience, for plant engineering project work. Reply to

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330 W. 42 St., New York 36, N. Y.

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Reply to P-4936, Chemical Engineering
330 W. 42 St., New York 36, N. Y.

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At least 2 to 3 years experience preferred; chemistry, physics or metallurgy background; to conduct chemical and spectroscopic analysis and mineral assay. Start as assistant analyst for training to become chief analyst in about a year. This is a permanent position with 12 month appointment on the staff of the School. Salary commensurate with experience and training.

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SALES ENGINEER. With experience in the sale of mechanical equipment, wanted for positions involving general application and sale of heating, ventilating, and air handling apparatus for commercial and industrial buildings, industrial processes, and mechanical draft. Positions are available at various locations. Personal interviews will be granted only after receipt of written application giving full details of experience. Address: Sturtevant Division, Westinghouse Electric Corporation, Dept. AH, Hyde Park, Boston 36, Mass.

SALES REPRESENTATIVE Wanted—Buffalo and Western New York territory. To handle complete line Mixing Machinery, Ball Mills, Industrial Fans and Blowers. Exclusive territory on commission basis. Leading manufacturer. RW-5047, Chemical Engineering.

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SALARIED POSITIONS \$3,500 to \$35,000. We offer the original personal employment service (established 42 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered, present position protected. Ask for particulars, R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

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SALES ENGINEERING organization with established following in chemical, Pharmaceutical and allied industries, desires to represent additional processing equipment manufacturer in New York, New Jersey, Delaware and Pennsylvania. Commission only. RA-4950, Chemical Engineering.

WORLD GIRDLING Chemical Engineers. Experienced, responsible, will execute business; establish contacts, make sales. Leaving late fall. RA-5025, Chemical Engineering.

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More than 40 ME, ChE, and chemist graduates available within next 3 months, after completing 2 years service in Army research and development. Average age 24; most had predraft experience. Desire inquiries from management or senior position with progressive chemical or metallurgical operating company or consulting firm.
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CHEMICAL ENGINEER

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PW-4942, Chemical Engineering
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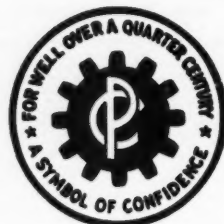
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- 1—42" Amer. T & M Co. S/S Centrifugal, 40 HP motor, suspended type.
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- 2—500 gal. steel jack, closed, agitated Vacuum Reactors, 125# jacket.
- 2—Dorr Classifiers, washing type; 2 stage 3'x26' long.
- 1—Colton #5½ Tablet Machine, 3" maximum tablet, m.d.

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SINGLE ITEMS

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PLANTS**



SEND US YOUR LIST TODAY!

- 1—Shriver 30"x30" jacketed, cast iron, Filter Press, 30 chambers, 1" cake.
- 1—42"x120" Buffalo Atmos-pheric Double drum Dry-er, S/S Conveyors, S/S Elevator, S/S hood.
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IN THE CHICAGO AREA**



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- 1—Abbe 5'x15' Tube Mill.
- 2—Swenson Walker double effect Evaporators.
- 3—Sperry 30"x30" Cast Iron Filter Presses, 2" cake.
- 3—Direct Heat Rotary Dryers, 5'x26', and 4'x30'.
- 1—Bird 24"x24" Centrifugal.

Miscellaneous: Screens, Air Separators, Redler Conveyors, Screw Conveyors, S/S Pumps, Bucket Elevators, Jacketed Crystallizers, Hammer Mill, Scales, Pumps, Exhausters, etc.

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2—Direct Heat Rotary Dryers; 5'x40' single shell, Ruggles-Coles. Also 2'7"x10' Roto-Louvre.

RAYMOND PULVERIZERS: 3—#5047 Raymond High Side, 7 1/2" face rolls, Whizzer Separators, New Oil Journals, complete.

1—#5057 5-roll Raymond High Side, with oil journals, piping complete.

FILTERS: 4—#12 Sweetland Filters for 36 leaves on 4" c/c; 502 sq. ft. f.a. One without leaves; one for 72 leaves on 2" c/c, 1004 sq. ft. f.a.

ALSO LIQUIDATING MACHINERY—NOT IN CHICAGO AREA

ROTARY KILNS AND DRYERS: 2—Rotary Kilns, 7'x120' Vulcan Iron Works, 8'x135'.
10—Direct Heat Rotary Dryers, class XA 4'x20', 4'6"x25' single shell.

RAYMOND PULVERIZERS: 2—Raymond 4-roll High Side Mills, each complete with 2—50 H.P. 3/60/2200 volt motors, connecting piping, etc.

BALL AND TUBE MILLS: 4—Traylor Tube Grinding Mills, siliceous lined, 5'x22', with herringbone steel gears; 5'x20', 4'6"x18'6", 4'6"x14'.

8—Pebble Mills, porcelain lined, 5' dia. x 4'; 3—6'x8', 800 gals. each.

MISCELLANEOUS: 2—UNUSED 18"x28" Bird solid bowl Stainless Steel Continuous Centrifugals.

4—Centrifugal Air Classifiers: 6' & 16' Raymond, 8' Gayco, 16' Sturtevant.

6—Devine #28 Vacuum Shelf Dryers, each 20 shelves 59"x78", Condensers & Pumps.

12—Shriver 42"x42", Cast Iron Filter Presses, Plate & Frame, 18, 27, 36, 54 chambers, 1" cake.

18—Sperry 18"x18", Cast Iron, P & F, Filter Presses, closed delivery, 11 chambers.

FOR INSPECTION—Contact our Representative at the Plant in East Chicago, Indiana or at Booth 51, Chicago Coliseum during Chemical Show.

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40" perforated, steel, Tolhurst.
40" perforated, SS, Fletcher.
24" Bird, CH, SS, series 200.

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8'x36"x3/4" Absorption (2—UNUSED).
5'x47"x3/4" Absorption, ASME 20 trays (2).
5'x38"x3/4" Absorption ASME, 14 trays.
3'6"x58"x3/4" Absorption.
6'x44"x2 1/2" Scrubber, 5" heads 225 PSI.
24"x13" C.I. Fractionating 18 plates.
6'x49"x3/4" Bubble Cap, 19 trays.
6'x29"8" Bubble Cap, SS, 21 trays.

DRYERS

Stokes, Rotary Vacuum, 30"x8", complete.
Blaw-Knox 5'x6" Atmos. single drum.
Stokes, 4'x9" Atmos. double drum.
Proctor & Schwartz 24"x28"9" Conveyor.
Proctor & Schwartz 8'x94"SS Conveyor Dryer.
Proctor & Schwartz, 6'x40" Conveyor Dryer.

FILTERS

8'x12' Feinc, all steel.
8'x10' Oliver, wood & steel (3).
11'6"x18' Oliver, all steel.
4'x5' Oliver, SS & wood (2).
#7 Sweetland, 2" spacing, 28 leaves.
36", 35 chambers, center feed, open.
12" Sperry, Aluminum Chambers.

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100M cu. ft. 2 lift, 56"x24" (2).
372 cu. ft., single lift, 9'x9'.

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Al. Chal. 400 sq. ft. Adm. tubes (NEW).
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Whitlock, 3,463 sq. ft. vert. (4).
Ross 60 sq. ft. Adm. tubes, steel shell

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5,500 gal. aluminum 8'x15"x3/4" agit. (2).
2,000 gal. agit. jack't'd. 200 PSI (3).
2,350 gal. ASME, jack't'd., agit., steel.
500 gal. Pfaudler, Type LL.
400 gal. Pfaudler, jack't'd., agitated.
40 gal. SS clad. 40 PSI, jack't'd. (4).

KILNS—COOLERS—DRYERS

1106-35 Roto Louvre.
10'x90"x9/16" Allis Chalmers.
5'x67"x5/16" with lifters.
4'x64"x3/4".
7'x60"x3/4" with lifters.
4'x35"x1/2" with burner.
5'6"x25" Allis Chalmers, complete.

MIXERS

Paddle, 19"x24"x18", complete w/drive.
Paddle, double shaft. 140 cu. ft. (NEW).
Readco 1 1/2 SA, 88 gals.
Blystone, 48"x67", 500 gals. (2).
Ajax, #3 Super, 173 gals.
Dayton, 100 gal., vert., steel, agit.

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135,000 gal. 30"x26" w/cols.
25,000 gal. 10'x40"x3/4" (NEW).
16,000 gal. 96"x45"x3/4" W.P. 150 PSI, ASME.
12,000 gal. 8'x32"x1/4" (NEW).
8,500 gal. vert. 8'x23"x5/16" (NEW).
4,100 gal. vert. 5'x28"x1/4" (NEW).
3,400 gal. 7'4"x10"x3/4", type 430 SS.
1,250 gal. 4'x14", 106 PSI.
1,200 gal. 42"x16'8"x5/16", 125 PSI.
1,050 gal. 4'x12"x1/2", 106 PSI.
12'x5'6" W.P. 1500 PSI (3).
6,500 gal. TANK CAR TANKS.

MISCELLANEOUS

Scraper Condenser 8'x15' aluminum (2).
Nash #27 Compressor with Separator.
5" Fuller-Kinyon Conveyor, complete.
4'x7" Tyler Hummer Screen, single deck.
600 gal. Copper Still.
1,500 gal. jack't'd C.I. Still.
Digesters — 3,900 gal. 75 PSI jacket agit. ASME U69.
Sublimation Vaporizers, 4'x10', jack't'd. agit.

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- 1—Stokes 6 shell 24" x 36" Vac. Dryer.
- 1—Stokes Dryer Double Drum 48" x 108"
- 1—Buffalo Dryer Double Drum 42" x 120"
- 5—Filter Presses 18" to 42" Wd Plate & Frame
- 2—Sperry 36" Filter Presses, Hyd. Closures
- 8—Stainless Steel Jack. Kettles with Ag. 100 to 950 gals.
- 2—Cast Iron Jack. Kettles 250 & 800 gals.
- 1—Stainless steel Jack. Mixer 75 gals.
- 1—Stainless steel Jack. Mixer—800# Cap.
- 1—W & P Mixer 100 gallon, Sigma Blades M.D.
- 3—M kro Pulverizers 2 TH and 2 FF—10 HP.
- 1—Gruendler W. B., Jr. 10 H.P. A.C. Motor
- 1—Robinson Size 1212, Rotary Cutter—10 HP, A.C. Motor
- 1—Raymond 16" Screen Mill—5 HP, A.C. Motor
- 2—Rotex Screens 40" x 60" and 40" x 120"
- 1—Robinson #18 Single Screen 40" x 104"
- 1—Stokes 43-A Granulator—S.S. Parts
- 3—Stokes Rotary "DS-3" and "DD-2" Tablet Machines
- 3—Stokes "F" Single Punch Tablet Machines
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- 3—Horis. Steel Tanks 3,000 to 12,000 gals.
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- 1—Nash Compressor, Model #H-7 with 150 HP motor.
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- 3—Sweetland Filters, #2, 3 & 7.
- 1—Shriver 36" x 36" Cast Iron Plate & Frame Filter Press, 48 Chambers, Closed Delivery, Steam Jacketed.
- 1—Shriver 24" x 24" Stainless Steel Jacketed Filter Press, 10 Chambers, Closed Delivery, 4 Eye, Washing Type.
- 1—Sperry 42" x 42" Cast Iron Plate & Frame Filter Press, 18 Chambers, Closed Delivery.
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- 1—Mikro #2-TH Pulverizer, Stainless Steel & Bronze Construction.
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- 1—Evedur Vacuum Kettle, 2,000 Gals. Cap.
- 2—J. P. Devine Steel Jacketed Vacuum Kettles, 2,000 Gals. Cap. Ea.
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- 1—Readco Lab Jacketed Vacuum Mixer, 2½ Gals. Cap., Sigma Blades.
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- 1—Steel Tank, 1000 Gals. Cap., 125 PSI.
- 1—Mikro #3-TH Pulverizer with 30 HP Motor.
- 1—Bullovak Pilot Plant Vacuum Double Drum Dryer, 6" x 8", Stainless Steel Drums.
- 1—Bullovak Pilot Plant Double Drum Dryer, 6" x 8", Stainless Steel Drums.
- 2—Bullovak Vacuum Shelf Dryers, 30 Shelves, size of shelves 5' x 160".
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- 1—Ruggles Cole Rotary Kiln, 7½' x 80'.
- 1—A. T. & M. 30" Stainless Steel Centrifuge, Perforated Basket, Underdriven.
- 1—A. T. & M. 40" Centrifuge, Centerslung Rubber Perforated Basket.
- 1—Tolhurst 14" Centrifuge Rubber Perforated Basket.
- 2—Bird Solid Bowl Stainless Steel Continuous Centrifugals, 18" x 28" (Used).
- 1—Sharpless Stainless Steel Super D Canter #PN-14.
- 1—Monel Bubble Cap Column, 3' x 9', 5 plates.
- 1—Oliver Rotary Experimental Steel Filter, 3' x 1'.
- 1—Shriver 42" x 42" Evedur Plate & Frame Filter Press, 40 Chambers, Closed Delivery.
- 1—Sparkler Monel Jacketed Filter, Model #33-S-28.

- 1—Sperry Aluminum 42" Plate & Frame Filter Press, 34 Chambers, Closed Delivery, 3" Frames (Unused).
- 1—Nickel Jacketed Kettle, 300 Gals. Cap.
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- 1—Stainless Steel Jacketed Vacuum Reactor, 180 Gals. Cap. with Agitator & Drive, ASME Constructed.
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- 1—Pfaunder Glass Lined Jacketed Vacuum Reactor 500 Gals. Cap. Series LL.
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- 6"x22", 9"x32", 12"x36", 6"x40".
- 1—9" x 36" Double Steel Roller Mill.
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- 3—Houchin 10" x 36", 4 Roll Granite Stone Mills.
- Abbe 6' x 9' Pebble Mill & other sizes.
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- Patterson 3 1/2' dia. Stainless Conical Blender.
- 1—Master Drum Type Blender 1000.
- Lancaster #3 Pan Mixer 7 1/2' H.P. M.D.
- 10—Dry Spiral Mixers 20 to 2500.
- 12—Portable Elec. Liquid Mixers to 3 H.P.

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- 4—French Oil Lined Cottonseed Hydr. Presses.
- Gould 75 H.P. Centr. Pump, 250 PSI.
- 4—French Oil Motor Driven Expellers.
- New 5' x 12' Abbe Mixing Mill & Calenders.
- 4—Farrel 2 Roll Rubber & Plastic Mills.
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- 1—Stokes 2E Paste Filler up to 5 gal.
- 1—Marco 2200 Stainless Steel Homogenizer.
- 1—Stokes & Smith 4' Dry Powder Filter.
- 1—Filling Machines, Liquid, Paste & Powder.
- 1—2 1/2' Colton 3" Preform Tablet Machine.
- Rotary & Single Arch Tablet Machines, 1/2" to 8".
- 2—New Nougat Barrel Bag Packers.
- 2—Revolving Pans 30" & 36".
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- 6—Devine & Buffalo Vac. Pumps.
- Soap Machinery for Toilet Laundry, Chig Liquid, Hydr. Presses, Pumps & Accumulators for Rubber & Plastics, Injection Molding Machines.
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- 3—Stainless Steel Jacketed Filters.
- 2—Plate & Frame Filters 25"—open del.
- 4—Tan 100,000 gals. each.
- 1—Shriver 16" Aluminum Filter 9-plates 9-frames.
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- 2—70" x 35" Ruggles Coles A-10.
- Single Shell: 4x30, 4x45, 5x30, 6x25, 5 1/2"x7x90.

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- 8", 10" & 16" Mechanical Air Separators.
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- 20" & #1 Raymond Automatic Pulverizer.
- 4x45, 6x80, 5 1/2"x7x90 & 8x60 Rotary Kilns.
- 8'-6" x 28" Silica Fused Tube Mill.
- Wetherill 8 Pole Mag. Sep. 18" Belt.
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- Heavy Media Separation Unit.
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- 6' x 12' Monel Vacuum Receiver
- 5' x 30" ADT Steam Tube Dryer
- Sweetland #5 Filter, 30 lbs. on 2" cent.
- Sharples ACVO S.S. Cent. Motorized
- 7' x 54" Copper Vac. Pan, coil type
- 300 gal Abbe Lenhart Mixer, 30 HP
- Tyler Niagara Screen, 3' x 6' one deck
- Stainless Still 48" dia x 25" high
- 7 1/2' x 106" Rotary Kiln, Brick lining
- Rotavac 42" x 106" Double Drum Filter
- Sharples PV-18 Super-D-Canter, S.S.
- Enterprises 7' x 60" Steam Tube Dryer
- Oliver 5'3" x 10' Rotary Vac. Filter
- Copper Still 48" x 30" column. Complete
- Sperry 36" x 18" Rotary Filter, 60 P. & Hyd. cl.
- Shriver 30" Filter, 25 plates 30 frames
- Sperry 18" Bronze Filter, 25 rec. plates
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- 7 1/2' x 60" Rotary Dryer, 1/2" shell
- Oliver 4' x 6' Cast Iron Rot. Vac. Filter
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- Resina Single Head Casper, 28 mm
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- 2—Oliver model 8' x 10' Rotary Vac. Filters.
- 1—Rogers Spray Dryer 16' dia. with all accessories.
- 2—Paudler 100 gal. glass-lined Stills with condensers, receivers.
- 4—Steel 2000 gal. jacketed, agitated, 200 psi Reactors.
- 1—Paudler 350 gal. glass-lined, jkt. agitated Reactor.
- 3—Dopp 250, 150 gal. jacketed, agitated kettles.
- 1—Quadruple Effect Evaporator, brass tubes 16,000 sq. ft.
- 1—Bullovak VRC, stainless steel Single Effect Evaporator 94 sq. ft.
- 1—Swenson Quadruple Effect Evaporator S.S. 2800 sq. ft.
- 1—Bullovak 6' dia. Vacuum Crystallizer.
- 2—NEW Absorption Towers, 13,500 gal. cap.
- 1—Vertical Storage Tank 30' dia. 26' high, 135,000 gal
- 12—Tubular Condensers 200 to 1000 sq. ft.

DRYERS—KILNS

- 1—Vulcan 8' x 135', $\frac{3}{8}$ " shell, 2-14" tires, complete.
- 1—Vulcan 8' x 115', $\frac{3}{8}$ " shell, 2-14" tires, complete.
- 1—Vulcan 7' x 120', $\frac{3}{8}$ " shell, 2-12" tires, complete
- 1—Allis-Chalmers 10' x 90', 9/16" shell, 2-14" tires, complete.
- 1—6' x 60', $\frac{3}{8}$ " shell, 2-8" tires, complete.
- 1—Link Belt 11'6" x 35' Roto-Louvre with hoods, blower, etc.
- 2—Link Belt 27' x 8' model, 27' x 10' steel, Roto-Louvre Dryers.
- 6—Rotary Dryers 7' x 70', 7' x 60', 5' x 67', 4'6" x 40', 4' x 25'.
- 2—Louisville Rotary Steam Tube Dryers 6' x 50', 6' x 30', 3' x 20'.
- 2—Devine 17 shelf double door Vacuum Dryers 59" x 78".
- 3—Bullovak 20, 15, 7 and 5 Shelf Vacuum Dryers 42" x 42".
- 5—Stokes & Bullovak Rotary Vacuum Dryers 30" x 8', 3' x 15', 6'6" x 38'.
- 1—Blaw-Knox Stainless Steel Rotary Vac. Dryer 42" x 8'.
- 3—Bullovak 42" x 120", 32" x 100", 32" x 90" Atmospheric Double Drum.
- 1—Single Drum 60" x 80" Flaker.
- 1—14 Truck steam heated Dryer 1680 sq. ft.

FILTERS

- 6—Valles Pressure Filters 360 and 540 sq. ft.
- 1—Sweetland #12 with 36 leaves.
- 1—Sweetland #10 with 36 steel leaves.
- 1—Sweetland #7 with 27 steel leaves.
- 8—Oliver Rotary Vacuum 11'6" x 14', 8' x 12', 8' x 10', 8' x 8', 5'3" x 6', 3' x 4', 3' x 1'.
- 3—Elmco Rotary Vac. 8' x 8', 4' x 5', 4' x 4'.
- 1—Oliver Rotary Vacuum Pressure Filter 3' x 4' steel.
- 1—Oliver 8' x 8' Rotary Precat Filter, rubber-lined.
- 1—Feinc Rotary Vacuum 8' x 12' steel with drive, etc.
- 4—Shriver 36" P&F, 30 chambers, C.L., closed delivery.
- 1—Sperry 36" Recessed, 48 chambers, C.L., open delivery.
- 5—Shriver 30" P&F, 30 chambers, C.L., open delivery.
- 8—Sperry 24" P&F, 16 chambers, C.L., closed delivery.
- 1—Shriver 24" Recessed, 30 chambers, C.L., open delivery.
- 3—Shriver 18" Recessed, 30 chambers, C.L., open delivery.
- 2—Sperry Aluminum 30" and 24" P&F, 22 and 26 chambers.
- 1—Shriver Aluminum 12" P&F, 8 chambers.

CENTRIFUGALS

- 1—Tolhurst 48" suspended, bottom discharge, rubber covered.
- 1—Tolhurst 48" Center Slung S.S., perforated basket.
- 1—AT&M 42" Suspended S.S., bottom discharge, perforated.
- 6—AT&M 40" Bronze Baskets, bottom discharge, perforated.
- 1—Fletcher 40" Suspended, Bottom Discharge, S.S., perforated basket.
- 1—Tolhurst 40" center slung, rubber covered, perforated.
- 2—Sharples C27, C20, 316 S.S. Super-D-Hydrators.
- 1—Tolhurst 32" Suspended Model, bottom discharge, perforated.
- 2—Bird 36" x 50" solid bowl, stainless.
- 1—Sharples P14 S.S. Super-D-Center.
- 4—Sharples #16 S.S. and steel.

PULVERIZERS

- 3—Raymond 5 roll, 4 roll High Side Mills complete.
- 1—Bauer 36" Attrition Mill 2-50 HP motors.
- 17—Patterson, Abbe Pebble & Ball Mills 60 to 1000 gals.
- 2—Premier Colloid Mills 8" dia., S.S.
- 1—Eppenbach QV7 Colloid Mill.
- 2—Jeffrey 36" x 24", 20" x 12" Hammer Mills.
- 2—Raymond 12", 4' Separators.
- 1—2 Roll Rubber Mill 6" x 12".
- 2—Mikro No. 181 Pulverizers, 5 HP motors.
- 1—Fitzpatrick Comminuting Mill 5 HP.

SCREENS

- 1—Selectro S.S. double deck 4' x 10'.
- 5—Sprout Waldron S.S. single deck, 40" x 84".
- 1—Robinson Single Deck 40" x 104".
- 1—Tyler Hummer 4' x 7' Single Deck.
- 5—Tyler Hummer 3' x 5' Triple Deck.
- 1—Abbe #2 Blatnergess Sifter.

MIXERS—ALL TYPES

- 7—Baker Perkins 200, 100, 20, 9 and $\frac{1}{2}$ gal., jacketed, double arm, sigma blades.
- 1—Baker Perkins 300 gal. Unidor S.S.
- 1—Baker Perkins 2 gal. Stainless.
- 1—Baker Perkins, type JNM, 100 gal., jacketed, double arm.
- 1—Day 30 gal. Imperial jacketed, double arm.
- 10—Day 200# to 3000# Powder Mixers.
- 12—Electric, Portable Agitators $\frac{1}{4}$ HP to 5 HP, NEW.
- 4—Day, Ross, 8 and 50 gal. Pony Mixers.

MISCELLANEOUS

- 20—Bucket Elevators, steel housings, 34' to 90' centers, 8" x 5" to 24" x 8" buckets.
- 7—Stokes Vacuum Pumps 15 to 100 CFM.
- 1—Milton Roy Proportioner Pump, S.S. and Hastelloy, 10 GPM.
- 5—Devine, Bullovak Condensers and Receivers, 20 to 90 sq. ft.
- 7—Green 150, 125 gal., S.S., jacketed, agitated, kettles.
- 4—Stokes DD2, D4 Rotary Tablet Machines.
- 5—38" dia. Stainless Steel Revolving Pans.
- 1—Nash Hytor Vacuum Pump 440 CFM.
- 10—Olivite, Durlon, Rubber, Durimet and Havez Centrifugal Pumps $\frac{1}{4}$ " to 4".

Write, wire or telephone for complete information

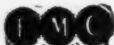
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2 Stainless Drum Dryers 5'x10' Complete
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Oliver Rot. Vac. Filter 6'x3'; Nickel contacts
50 Gal. Nickel Steam Jkt'd. Kettle; 31"x22"
Pfaudler 400 Gal. Jkt'd. Glass Lined Reactor
Stainless 475 Gal. Jkt'd. Agitated Kettle
Ball & Jewell Stainless Rot. Cutter #1½; 40 HP
Rietz RD18 Stainless Disintegrator; 30 HP
Stainless Saw Tooth Crusher; 10"x11"
NEW Stainless Double Ribbon Mixer; 24"x96"
Stainless Tumbling Batch Mixer; 5'x5'
Readco Nickel Double Arm Mixer; 38"x34"x38"
Baker Perkins Stainless Lab. size Double Arm Mixer
Monel 250 Gal. Jkt'd. Agitated Reactor
Oval Truck Tanks Stainless; 2200 gal. and 3500 gal.
Acid Proof Tile Lined Autoclaves; 3375 gal. 6'10"x14'
Large Stock of NEW Stainless Kettles; all sizes
2 Bird Rubber Covered 48" Centrifuges; 2 speed 40 HP
Swenson Jacketed Crystallizers; 24"x10' and 12'; 5 HP
Bird-Young Rotary Vac. Filters; 4'x4'; SS screens
Shriver 36" Rubber Covered C.I. Filter Press; 34 chambers
Sweetland Filters No. 2, No. 7, No. 10 and No. 12
Oliver Dorco Rotary Vacuum Filter; nickel contacts 6'x3'
Williams No. 4 Hammer Mills; require 60 HP motor
International Porcelain Lined Pebble Mills; 8'x3'; 50 HP
Abbe Buhrstone Lined Pebble Mills; sizes up to 5'x6'
American Ring Roll Crusher; 30"x37"; 50 HP motor
2 Dopp Cast Iron Jacketed-Agitated Kettles; 650 Gal.
J. H. Day Jumbo Mixer; 44"x78" with 10 HP and Reducer
Lancaster Model EAG4 Muller Type Mixer with all accessories
Buffalo 20 Shelf Vacuum Chamber Dryer; 40"x42" complete
Koch Tray Type Electric Ovens; 56"x68"x72" complete
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SCREENS—15 x 48 double Selectro w/ motor.
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MOTORS—50-75-100 HP Slow Speed Slip Ring.
FILTER PRESSES—Shriver 24" x 28 P&F—Closed—30 w/28 P&F open, washing.
—30" Shriver w/30 P&F—closed washing.
BALL MILL—24" x 18" w/Stainless dust hood.

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1—3" Cash Standard type 33P Pilot operation back pressure control Valve.

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- 1 Aluminum Perforated Plate Column, 28" dia. x 38 plate.
- 1 Copper Bubble Cap Column, 42" dia. x 31 plate.
- 1 Copper Bubble Cap Column, 30" dia. x 22 plate.
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- 1 Copper Perforated Plate Column 24" dia. x 14 plate.
- 1 Steel and Cast Iron Bubble Cap Column, 30" dia. x 82 plate.
- 1 Stainless Steel T316 Raschig Ring packed column, 24" dia. x 6'8" high.
- 1 Stainless Steel T316 direct fired Vacuum Still, 325 gal.

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- 3 Aluminum tub. 166 sq. ft.
- 6 Copper tub. 65, 95, 135, 330, 420, 487, and 725 sq. ft.
- 2 Stainless Steel tub. 8½ x 39 sq. ft.
- 4 Stainless Steel Coil Condensers, 40 sq. ft., 60# pr.

DRYERS—EVAPORATORS

- 1 Louisville Rotary Steam Tube Dryer, 5' dia. x 20'6" long; with screw press.
- 1 Stokes #59A Jacketed Vacuum Rotary Dryer, 18" dia. x 42" long.
- 2 Atm. Double Drum Dryers, 22" x 38".
- 1 Cummert Rotary Hot Air Dryer, 46" dia. x 26" long.
- 1 Struthers Wells Evaporator, 100 sq. ft. tube bundle.

FILTERS

- 1 Sweetland #10.

1 Swenson Rotary Continuous Vacuum Filter; Precoat type, 8' dia. x 8' face, rubber covered and lead acid proof construction.

1 FEINC Rotary Vacuum Filter, string discharge, 4'6" dia. x 6' face, aluminum.

- 1 Eitel Bronze Disc Filter, EX-40; 90 sq. ft.
- 4 Pressure Leaf Filters, 70 to 90 sq. ft.
- 15 Filter Presses, Cast Iron:
- 4 Shriver 36" rubber covered, closed dely. washing.
- 1 Shriver 30" rubber covered.
- 1 Shriver 30", 35 rec. pl., open dely.
- 1 Shriver 24", 40 ch., open dely., wash.
- 1 Shriver 24", 24 ch., closed dely.
- 1 Sperry 24", 15 rec. pl., open dely.
- 1 Shriver 24", 28 ch., closed dely.
- 1 Shriver 24", 12 ch. cl. dely., wash.
- 2 Louisville 8-roll Continuous Grains Presses, 24" and 36" wide.

KETTLES—REACTORS

- 1 Stainless Steel, Type 347 Autoclave or pressure tank; 250# pr. Elec. heated 850° F; 17¼" dia. x 9' high.
- 70 Stainless Steel and Stainless Clad open top, steam jacketed kettles—10, 40, 60, 80, 100, 150, 250, 500 gal. sizes.
- 1 Stainless Steel Kettle, 950 gal., 20# jkt. pr., vertical agitator, Type 347 shell, bolted C.I. top.
- 4 150 gal. Stainless Steel Steam Jacketed Kettles, open top, with double motion agitators.
- 3 300 gal. T316 Stainless Steel Jacketed Tanks, water jkt. double motion agitators.

1 200 gal. Read Stainless Steel Jacketed Kettle, open top, double motion agitator, 10 HP motor.

- 1 3000 gal. Horiz. Steel Cooker. Vacuum. Agitated.
- 1 2000 gal. Vertical Steel Cooker, agitated.
- 1 Lead Lined Kettle, 500 gal., closed top, with coils, jacket & agitator.
- 1 Aluminum 100 gal. Reaction Kettle, Jkt'd. & Agit.
- 2 Copper Jacketed Agitated Vacuum Kettles, 4' dia. x 4' deep, double motion agitator.

MILLS—PULVERIZERS

- 2 Paul Abbe #6 Pebble Mills, porcelain lined, 32" x 38".
- 1 Abbe #4A Pebble Mill, 45" x 48".
- 1 Hardinge Conical Ball Mill, Steel Liner, 4'6" dia. x 24" long.
- 1 Williams Hammer Mill, type AK; size A, stainless steel.
- 3 Mikro Pulverizers, #1-SH, #2-SL, #2-TH.
- 1 Premier Colloid Mill, type U-3, 6" st. st. rotor.

MIXERS—AGITATORS

- 1 Porier heavy duty jacketed double worm mixer—75 gal.
- 1 Dellenberger 100 gal. Heavy Duty Double Arm Mixer, fish-tail blades, jacketed.
- 1 Broughton Powder Mixer, double arm, 50 cu. ft.
- 10 Copper Conical Blenders, ½, 1, 7 & 11 cu. ft.

JUST PURCHASED

8—15,000 gal. Vertical Welded Steel Closed Fermenting Tanks, 80 lbs. W.P., turbine agitator with 30 HP motor; 970 lin. ft. 3" pipe coil. Excellent condition.

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- 18 Horiz. Welded Steel Tanks, Lastiglas Lined, 15,200 gal.
- 3 Horiz. Welded Steel Tanks, Lastiglas Lined, 5800 gal.
- 18 Vertical Welded Steel Tanks, closed Mammut Lined, 7700 gal., 7000 gal. & 2300 gal.
- 1 Vertical Rubber Lined, 6000 gal.
- 5 Vertical Jacketed Pressure Tanks—steel—30# steam jacket—6mm vacuum internally:
- 3—34" ID x 15' H (approx. 700 gal.)
- 1—23" ID x 10' H (approx. 230 gal.)
- 1—23" ID x 9' H (approx. 195 gal.)

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- 1 16,200 gal. Vert., closed, T304—NEW
- 1 5700 gal. Horiz. T304—NEW
- 1 4200 gal. Vert., closed, T304—NEW
- 1 2350 gal. Vert., open, T302—NEW
- 1 1400 gal. Vert., open, 10' L x 57" W x 57" D
- 2 1000 gal. Vert., T304—NEW
- 2 500 gal. Vert., T304—NEW
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- 12 3000 gal. Horizontal Stainless Steel Tanks, 3'4" dia. x 18'9" long, insulated and agitated. Excellent for transporting, storage or holding.

MISCELLANEOUS

- 1 Bird Suspended 48" Steel Centrifugal, Perforated basket; Bottom discharge.
- 1 Fletcher 30" Jr. Centrifugal Extractor, St. St. Imperi. basket.
- 1 Sharples #16 Super Centrifuge, stainless steel.
- 1 Spencer Turbine Co. Gas Booster or Compressor, stainless steel, 30 HP motor, 600 CFM at 80 ps. pr.
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2 Kux Machine Co. Model 25 Rotary Pellet Presses, 21 and 25 punch—with motor and vari-drive.

- 6 Stokes Rotary Pellet Presses, 16 punch, B-2, D-3, D-4.
- 1 Byron Jackson Deep Well Pump, 150 GPM 325' head, NEW.
- 3 Selectro Vibrating Screens, stainless steel, 2' x 7', double deck, enclosed.
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- 1—250 gal. working capacity Bendco stainless steel double arm sigma blade Mixer with 50 hp. M.D.
- 1—12 x 24" Farrel-Birmingham 2-roll Rubber Mill with 25 hp. drive.
- 1—New 3000 gal. vertical S.S. Storage Tank.
- 1—Bullovac triple effect Evaporator, 300 sq. ft. per effect.
- 1—Paudler 3' S.S. vertical Vacuum Pan.
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- 2—Day 100 gallon sigma arm jacketed Mixers.
- 50—Stainless steel Tanks (New and Used) up to 1000 gallons.
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- 4—J. H. Day 40 gallon Pony Mixers.
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- 1—20 gal. Stokes S.S. Vacuum Pan.
- 2—5 x 12' Bullovac vacuum Drum Dryers.
- 1—Day 3000 lb. jacketed Powder Mixer.
- 10—3000 gallon vertical closed Steel Tanks.
- 5—Day 12 x 32" 3-roll Mills.
- 3—Double drum Atmospheric Dryers—42 x 120", 32 x 90", 24 x 80".
- 6—8' x 40" Rotary Hot Air Dryers.
- 8—Dry Powder Mixers—100 to 3000 lb. cap.
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- 1—24" x 48" stainless steel single drum Atmospheric Dryer.
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- 1—New Premier 3" stainless steel Colloid Mill with 7½ hp. motor.
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Pumps, vacuum equipment, piping
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3500 gal. working cap. Steam Jacketed, Double Arm Mixing Tanks for mixing, storing or processing of your materials.

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- 1—Pony Mixers, 8, 15 and 40 Gal.
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- 3—32"x50" Buffalo Double-Drum Dryers.
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- 3000 gal. S.S. Truck Tanks, Trailered.
- 75 gal. Monel jkt. Kettle, 35"x27", agit.
- 100 gal. S.S. Clad Jkt. Kettle, 30"x32"
- 150 gal. S.S. Jkt. Kettle, 42"x34", agit.
- 300 gal. Plaudier Horiz. Glass Lined Tank, 25"
- 4—50 gal. Steel Kettles, 75" jkt., A.S.M.E.
- Greundler Jr. Pulverizer, 10 H.P.
- 75 to 1500 gal. Homogenizers or Viscosizers.
- 26" Centrifugal Extractors, copper baskets.
- 60" Centrifugal Extractors, s.s. baskets & curbs.
- Model 148C Stokes High Vacuum Pump, 1½ H.P.
- 2" S.S. Centrifugal Pump, 2 H.P.
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- 30 ton Howe Suspension Tank Scale

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275-ton Ingersoll-Rand barometric steam jet refrigeration unit, fully comp. with pumps, motors, and all access. equip. New 1943, used 2 yrs., condition like new. Detail specifi. and price will be mailed on request.

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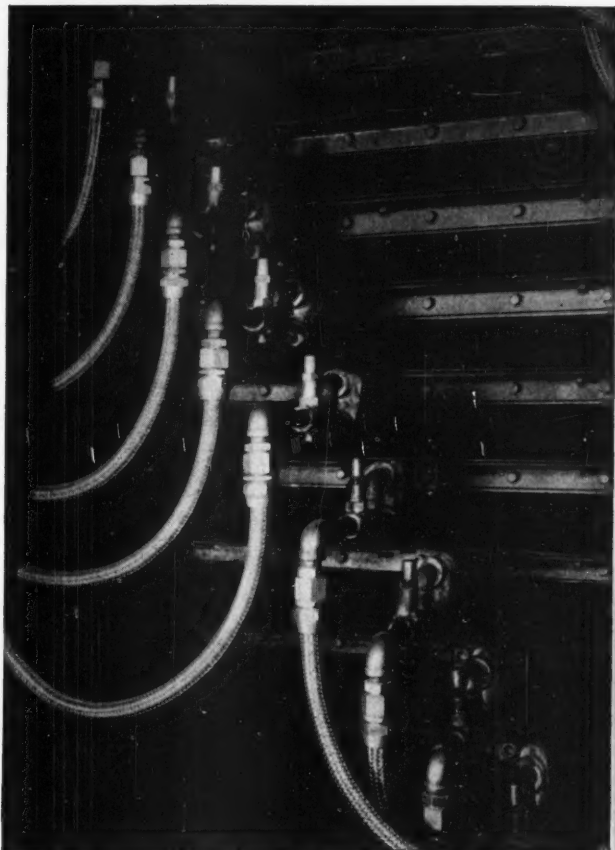


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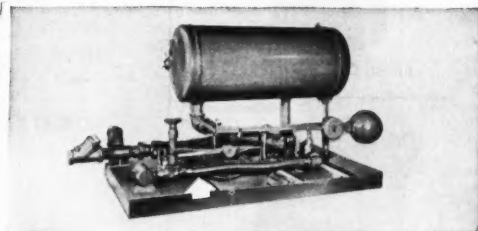
News about flexible metal connectors

Here they prove dependable for
PRESSURE, COLD and HEAT

PRESSURE Harbor Plywood's veneer press uses American $\frac{1}{2}$ " I.D. Seamless Bronze Connectors with braid for added pressure resistance. American Flexible Metal Connectors are ideal for this use because they're corrosion-resistant. They come with fittings attached and are easily installed. Manufacturers, like Harbor Plywood, find American Connectors the right solution to tough design problems because of their flexibility, both in assembly and operation, and their long life with little maintenance attention.



COLD For conveying Freon in truck refrigeration systems, The Schnabel Co. uses American Vibration Eliminators. These connectors operate between 10° and 40° F. at 180-200 p.s.i. American Flexible Metal Connectors are the best answer where moving lines must be connected, flexible shafts protected, or assemblies made in restricted spaces.



HEAT Morehead Manufacturing Company uses American Seamless Bronze Flexible Connectors on their "back to boiler" steam trap. This connector has the ability to resist high steam temperature and pressure as well. American Flexible Metal Connectors may also be used to carry corrosive liquids, gases, or semisolids.

WRITE FOR BOOKLET SS-50—shows how the tubing is designed, used, and installed—gives specifications on tubing and fittings. The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Company, Limited.

wherever connectors must move... *American* flexible metal hose and tubing

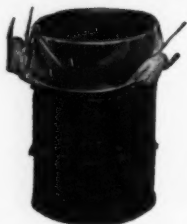
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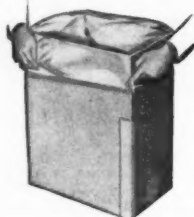
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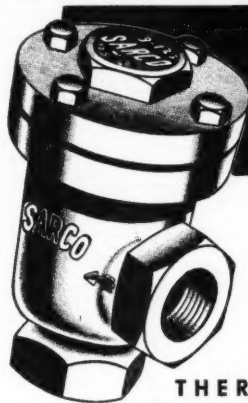
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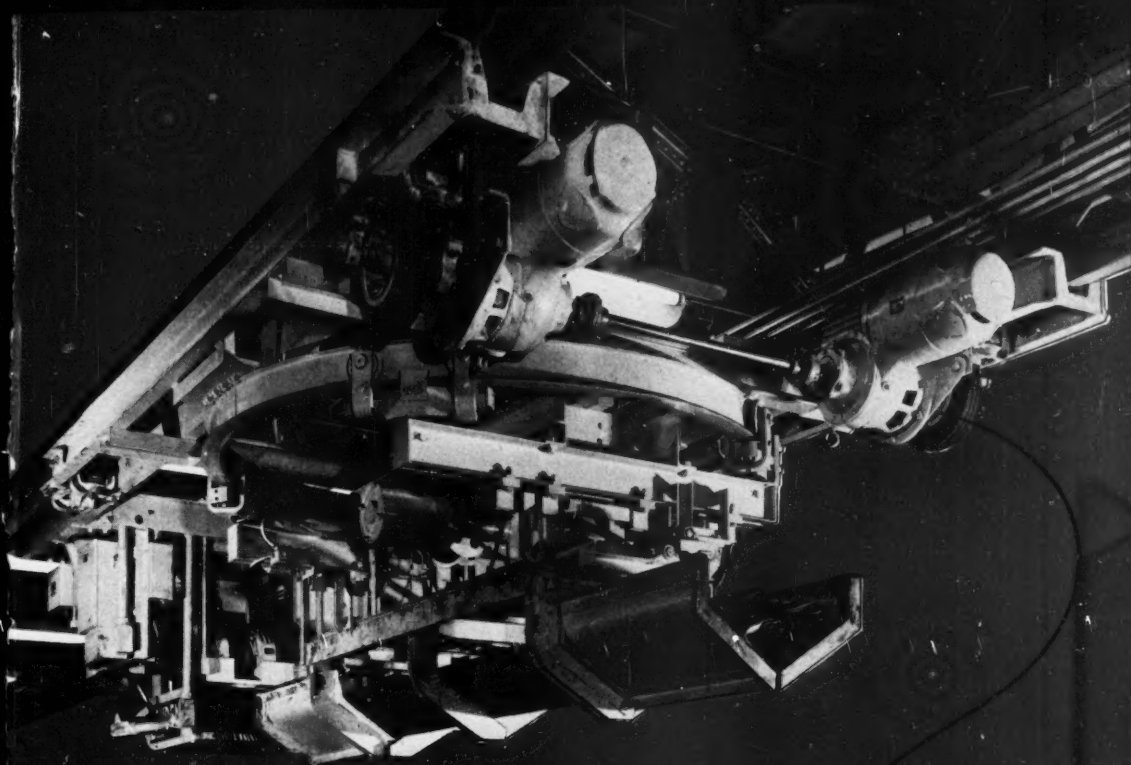
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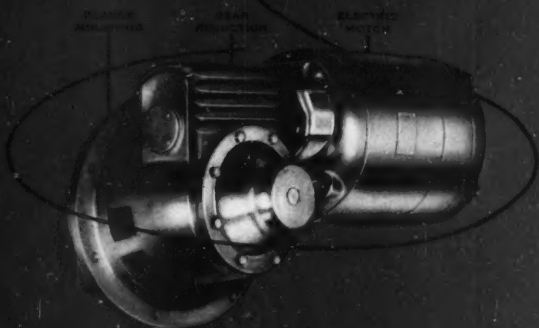
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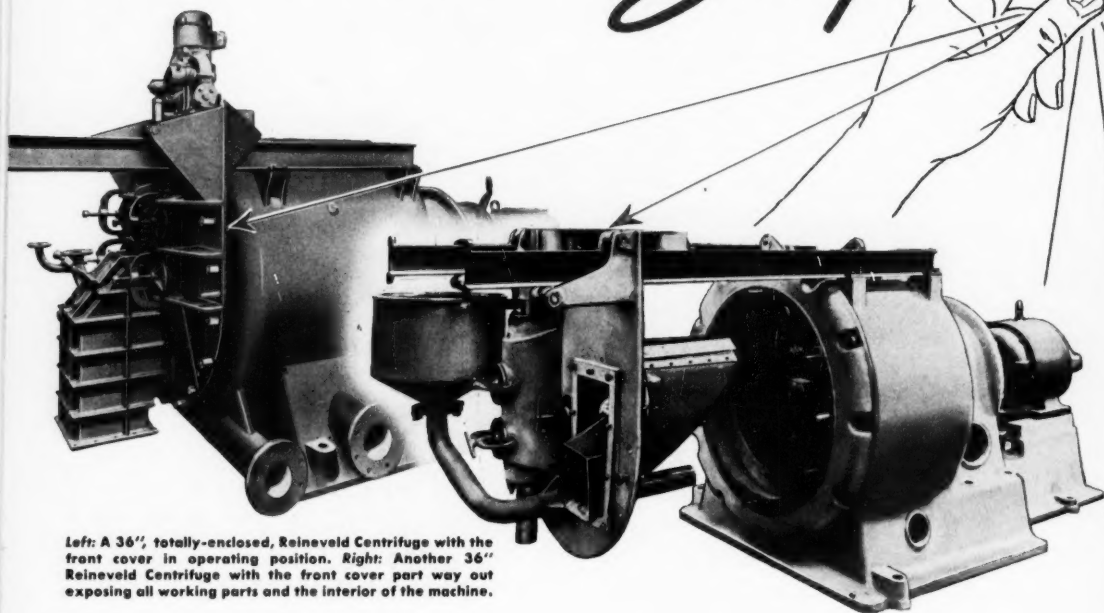
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